# Crop production potentials for land evaluation in Canada

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J. Dumanski and R.B. Stewart
Land Resource Research Institute

Research Branch
Agriculture Canada
1981

## ACKNOWLEDGEMENTS

This study was undertaken by the Land Use and Evaluation Section and the Agrometeorology Section of the Land Resource Research Institute, Agriculture Canada, as part of the ongoing research in agricultural land evaluation. A special, small steering committee was established for the project. This consisted of the authors, plus Dr. K.B. MacDonald who made many useful comments on the design of the project and was involved in data input, Dr. J.G. Girt (Regional Development and International Affairs Branch) who supervised the input of the socio-economic data, Mr. A. Desrochers (Systems and Consulting Division) who looked after the data management aspects of the project, and Mr. E.C. Huffman who supervised most of the data input. The authors are greatly indebted to this group for their considerable contributions to the project.

The soil map was digitized by the cartography unit of the Land Resource Research Institute. The same group prepared all the final maps for publication. The detailed programming for data base management was undertaken by Mr. J. Buchanan, Systems and Consulting Division. Mr. D. Russelo, R. Sharp and D. Chaput all assisted in programming the crop growth model.

The project was assisted with special funds from the Land Evaluation Contract Research program. Students from the University of Waterloo Cooperative Geography Program working under contract did most of the data input and part of the analysis. The students were J. Brittain, A. Lamb, D. Patterson, J. Sellers, R. Van Eyk and R. Wallis. Their unselfish contributions to the project are gratefully acknowledged.

Photographs were supplied by the John Deere Company, Agriculture Canada, E.C. Huffman, J. Nowland, K. Dubroy and H. Tewsley.

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## SUMMARY

This report describes a method and provides data for estimating crop yield and production potentials for spring wheat, corn, soybean, phaseolus bean and potato in Canada. The assessment was done at a scale of 1:5,000,000, and it was based on map units from the Soils of Canada.

The procedure involved developing a large integrated data base consisting of soils, climate and agricultural land use. The Soils of Canada map was digitized and stored on computer, utilizing the capacities of the Canada Soil Information System. A large, extended legend was then prepared, relating all variables to the individual map units. These basic data were used as input variables to programmed crop growth models from which potential and anticipated yield estimates were calculated. The derived yield values were then added to the data base as discrete variables.

Potential net biomass and dry matter yield values for each crop were computed using procedures described by FAO. Potential values were determined using a form of de Wit's photosynthesis model which calculates crop photosynthesis response to temperature and radiation averaged over a growing season. Anticipated yields were derived from these values by employing yield reducing factors including moisture stress, fall workday probability and soil constraints.

The results of the procedure were expressed as a quantitative land suitability assessment. The anticipated (corrected) yield for each map unit was compared to the maximum potential yield for that crop in the country. On this basis each map unit was classified for each crop into one of six suitability classes. Areas with anticipated yields of less than 20 per cent of maximum potential were considered as not suitable for that crop. Results were expressed as maps and as tables showing amounts of land in the various classes of suitability relative to climate classes, soil groups and growing season lengths.

Total crop production potentials for all crops considered were calculated, and expressed on a provincial basis. This was accomplished by overlaying provincial boundaries with the Soils of Canada map, and incrementing map unit anticipated yields and areas suited within the boundaries of a province. These values were then compared with current provincial production values. The results showed a sizeable residual potential for spring wheat in the prairie provinces, and for corn, soybean and phaseolus bean in Ontario. A discussion of current land use practices in Canada and the future implication of these for crop production is included in the appendix to this report.

# 1. INTRODUCTION

This report is one of a series of country studies which collectively constitute a global evaluation of agroecological crop yield potentials. In 1976 FAO initiated a study of crop yields by agroecological zones to obtain a first approximation of the production potential of the world's land resources, and so provide the physical data base necessary for planning future agricultural development. Current projections indicate that an increase of 60 per cent in global agricultural production will be required to sustain world populations by the year 2000 (FAO, 1978). The possibility of achieving this target has prompted much debate, but very little precise information exists on which to base a reliable answer.

Previous estimates of the global extents of arable lands to support present and future human populations vary from 3 to 7 billion hectares. Estimates of the populations these lands can support vary from 7.5 to 40 billion. These estimates however, do not consider production potentials for different crops (not all crops can be grown in all areas), or the effects of varying levels of inputs and technology, such as the effect of substituting capital for land and labour.

The FAO project consisted of using photosynthetic and phenological crop growth models to calculate biological crop yield potentials for discrete land areas. The basis of the project was a land inventory consisting of the Soil Map of the World (FAO 1974) at a scale of 1:5,000,000 with superimposed climatic characterization. The Canadian project is at an equivalent scale, but the basis of the work is the Soils of Canada map (Clayton, et al., 1977). This map is a refinement of the Canadian portion of the Soils of the World map, consisting essentially of more detailed subdivision of many of the large mapping units shown on the Soils of the World. Thus the two projects are wholly compatible, except that in the Canadian study more detailed data are available.

This project is of fundamental importance at a global scale, but it is equally important at the country level. In the case of Canada, even with a developed, capital intensive and highly technological agriculture, reliable estimates of crop production potential are not available on a national scale. Such estimates are required on a continuing basis for a number of activities including: agricultural development agreements; market and transportation planning; commodity planning and development; agricultural infrastructure, and service planning and development; agricultural research planning and evaluation; interprovincial and international trade; food policy development; and so forth. By comparing estimates with current crop production and land use at the farm level, indices of production potential could be developed for discrete, natural soil areas. Ultimately land budgets for individual crops relative to market possibilities could be devised.

This study reports on the crop production potential of Canadian land resources for five major field crops (the FAO agroecological study considers eleven crops, but of these only five are applicable to Canada). It provides estimates of unit area yields for spring wheat, corn, soybean, potato and phaseolus bean*, as well as extent and location of areas suitable for the production of these crops. The results of this study are interpreted within the context of what is currently happening to Canadian agricultural land resources, and the forces at play that affect these resources over the long term. Highlights of this are discussed in the appendix to this report.

The principles and general procedures for the study were borrowed from FAO (1978), but the details of the methodology were developed by the authors with assistance from colleagues in the Land Resource Research Institute and Regional Development and International Affairs Branch of Agriculture Canada.

The methodology described in this report is independent of scale, i.e., the principles and procedures can be applied in any area and at almost any given scale. The precision of data required, however, (climatic, soil and crop growth data) vary with scale, increasing progressively as scale increases. Correspondingly the reliability of the output varies, becoming increasingly more precise as the precision of base data input increases. In this study, data input was tailored to the intended scale of the project (1:5,000,000). Consequently the output reflects this scale of application, and should not be used for local yield estimates. Also, the values reflect long term, average production potentials and do not consider variations due to annual weather patterns.

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* Phaseolus bean is interpreted as field bean throughout this study.

## 2. METHODOLOGY

The methods used in the evaluation of the production potential of Canadian land resources were modelled on those outlined by FAO (1978). FAO procedures consisted of comparing soil and climate requirements for individual crops with computed growing conditions for each agroecological zone. Constraint-free and anticipated yields were calculated for each area meeting the minimal requirements using mathematical crop yield models. Results were expressed in a suitability classification, as a percentage of maximum potential yields.

Although the basic principles of the above procedures were followed, deviations were instituted to make the results more pertinent to Canadian applications, or where data more detailed than those available to FAO were available. The entire procedure is described in the following sections. Details of the modelling procedures used to evaluate potential crop dry matter yields and various agroclimatic constraints to crop production are given in a separate report (Stewart, 1980).

### 2.1 SOIL AND CLIMATE REQUIREMENTS FOR CROPS

Information for individual crops (spring wheat, corn, potato, soybean and phaseolus bean) was obtained primarily from FAO (1978, 1979), and modified where necessary from data compiled by Dubé (1977). The crops used in this study were allocated to one of two groups depending on their photosynthetic pathways. The major requirements of each crop are shown in Tables 1 and 2.

### 2.2 LAND INVENTORY

#### 2.2.1 Data Compilation

The inventory of existing land resources for crop production was developed by computerizing all available soil and climate information for Canada. The basis of the inventory was the Soils of Canada map (Clayton et al., 1977), compiled originally as part of the FAO Soil Map of the World project (FAO, 1974).

Initially the Soils of Canada map was digitized using procedures developed by the Canada Soil Information System (Dumanski et al., 1975). This provided a computerized data base for the manipulation of map units and for area calculation.

Concurrently a large extended legend of basic information was developed for each map unit and entered into the computer. Each map unit was identified by eleven data items, consisting of the Canadian map unit symbols, FAO map unit symbols, dominant and subdominant soil subgroup, soil phase, physiography and elevation, soil climate (temperature and moisture), land use, an agroclimatic resource index (ACRI) (Williams, 1975), soil capability, climatic grid point location, and census divisions and subdivisions.

TABLE 1

CROP ADAPTABILITY INVENTORY

PHOTOSYNTHESIS CHARACTERISTICS

| Characteristic | | Group I<br>Potato<br>Phaseolus Bean<br>Wheat<br>Soybean | Group IV<br>Maize<br>(corn) |
|---|---|---|---|
| 1) Photosynthesis Pathway | | $C_3$ | $C_4$ |
| 2a) Temperature Response to Photosynthesis for all crops except soybean | Optimum | 15 - 20°C | 20 - 30°C |
| | Operative Range | 5 - 30°C | 10 - 35°C |
| 2b) Temperature Response to Photosynthesis for soybean | Optimum | 20 - 25°C | |
| | Operative | 15 - 30°C | |
| 3) Radiation Intensity at Max Photosynthesis | | 0.2-0.6 $cal\ cm^{-2}\ min^{-1}$ | 1.0-1.4 $cal\ cm^{-2}\ min^{-1}$ |
| 4) Max net rate of $CO_2$ exchange at light | | 20 - 30 $mg\ dm^{-2}\ h^{-1}$ | 70 - 100 $mg\ dm^{-2}\ h^{-1}$ |
| 5) Max crop growth rate | | 20 - 30 $gm^{-2}\ day^{-1}$ | 40 - 60 $gm^{-2}\ day^{-1}$ |
| 6) Water Use efficiency | | .4 - .8 $kg/m^3$ | .8 - 1.6 $kg/m^3$ |

TABLE 2 SOIL AND LAND SUITABILITY REQUIREMENTS OF CROPS

| Crop | Slope (%) | | Soil Depth (cm) | | (1) Soil Drainage Class | | (2) Soil Texture Class | | Inherent Fertility Level | Salinity (mmho/cm) | | pH (1:2.5) | | $CaCO_3$ (%) | | Gypsum (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Optimum | Marginal | Opt. | Marg. | Opt. | Range | Opt. | Range | Marginal | Opt. | Marg. | Opt. | Range | Opt. | Marg. | Opt. | Marg. |
| Wheat | 0-8 | 9-30 | 50 | 10-50 | MW-W | I-SE | SiL-CL | SL-MC | Moderate | 0-5 | 6-10 | 5.5-8.2 | 5.2-8.5 | 0-25 | 26-50 | 0-2 | 3-20 |
| Maize | 0-8 | 9-15 | 50 | 10-50 | MW-W | I-SE | SiL-CL | SL-MC | Moderate | 0-4 | 5-6 | 5.5-8.2 | 5.2-8.5 | 0-15 | 16-25 | 0-0.2 | 0.3-2.0 |
| Potato | 0-8 | 9-15 | 75 | 50-75 | W-SE | MW-E | L-SiCL | FS-KC | Moderate | 0-3 | 4-6 | 5.5-7.0 | 5.2-8.5 | 0-15 | 16-25 | 0-0.2 | 0.3-2.0 |
| Soybean | 0-8 | 9-20 | 75 | 50-75 | MW-W | I-SE | SiL-CL | LS-KC | Moderate | 0-4 | 5-6 | 5.5-7.5 | 5.2-8.2 | 0-15 | 16-25 | 0-0.2 | 0.2-2.0 |
| Phaseolus Bean | 0-8 | 8.20 | 75 | 50-75 | MW-W | I-SE | L-CL | LS-KC | Moderate | 0-1 | 1-2 | 5.5-7.5 | 5.2-8.2 | 0-15 | 16-25 | 0-0.1 | 0.1-0.5 |

(1) VP = very poor
P = poorly drained
I = imperfectly drained
MW = moderately well drained
W = well drained
SE = somewhat excessively drained
E = excessively drained

(2) MC = Montmorillonitic clays
KC = Kaolinitic clays
SC = sandy clay
SiC = silty clay
CL = clay loam
SCL = sandy clay loam
SiCL = silty clay loam
L = loam
SL = sandy loam
SiL = silt loam
Si = silt
LS = loamy sand
FS = fine sand

The first seven data items (Canadian map unit to land use inclusive) were coded directly, as they were available from the legend of the Soils of Canada map. The remaining four data items, required some manipulation before being coded into the extended legend.

The ACRI values for each map unit were defined by superimposing a map of ACRI isolines onto the Soils of Canada map. Generally, the lowest and highest values of the isolines surrounding each map unit were selected, with adjustment for highly irregular map units.

The soil capability was compiled by visually estimating the proportion of soils of different capability class and subclass contained in each map unit. This exercise was completed by enlarging the Soils of Canada map to a scale of 1:1,000,000 and superimposing this onto available capability maps. Up to four capability units were entered for each map unit.

Climatic information was obtained from Environment Canada in the form of 1290 equal area grid squares based on one degree increments of latitude (G. den Hartog, personal communication). These data were calculated by interpolation of climatic normals from over 1800 climatological stations located throughout Canada. Each grid square represented an area of 10,000 $km^2$ and contained data on precipitation, mean, maximum and minimum air temperature, (reduced to sea level), vapour pressures, windspeed and incoming global solar radiation.

Climatic information for each soil map unit was computed from the grid square climatic inventory. This was accomplished by superimposing the grid square framework onto the 1:5,000,000 scale Soils of Canada map and estimating the area of each soil unit contained in each grid square. From this the basic climatic data for each individual soil unit were obtained from a simple weighting procedure in the form:

$$D_k = \sum_{i=1}^{n} ((A_{Ki} \cdot V_i)/A_{KT}) \qquad (1)$$

where: D is the weighted arithmetic mean for soil unit K

i is a subscript denoting a grid square containing soil unit K, n represents the number of grid squares containing soil unit K.

V is the climatic variable for grid square i,

$A_{Ki}$ is the area of soil unit K contained in grid square i,

$A_{KT}$ is the total area of soil unit K.

Using eq. (1) the entire grid square climatic inventory was converted to values representing individual soil map units. These data were used in computing all growing season climatic information.

Census data* were integrated to the Soils of Canada map units by selecting and coding those map units which covered 70 per cent or more of an individual Census Subdivision (CSD) and disregarding all others. Using this procedure 23 per cent of all soil units and 61 per cent of CSD's having 10 or more farms were entered. Considering the small proportion of the country's land base that is used for agriculture, and with an average of seven CSD's per soil unit, it was assumed that this resulted in a sufficiently representative match to permit an analysis of the structure of Canadian agriculture.

### 2.2.2 Calculation of Derived Variables

A series of derived variables for each soil map unit was calculated. These included the weighted arithmetic means of all basic climatic data contained in the grid square climate inventory, as well as a series of mean growing season variables required specifically for use in computing the constraint free and anticipated crop yields. Details of the calculations involved are summarized in the following sections.

#### i. Climate derived variables

The Agro-Ecological Zones project (FAO, 1978) uses a moisture based definition to quantify the crop growing period. This is defined as the period during the year when precipitation exceeds half the potential evapotranspiration plus a period in days required to evaporate or reduce the water stored in the soil by 100 mm. Temperature is considered by subtracting the number of days that the mean air temperature is less than 6.5°C during this period.

A water based definition for the growing period is probably adequate in parts of the world where temperatures generally are not restrictive to plant growth. In Canada, however, temperatures are the major limiting factor to crop growth and consequently a thermal growing period was defined based on the "frost free period". In this study the growing season length was the period in days during the time when the mean minimum air temperature was greater than or equal to 5°C. The selection of 5°C as the start and end of the growing season represents the average dates of the last spring and first fall killing frosts with a 50 per cent probability (Sly and Coligado, 1974). Moisture was not considered in the definition but incorporated later as a moisture stress agroclimatic constraint on crop development and yield.

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*Census data are not required for the calculation of production potential, and thus no further comment on their use will be made. Their mention is included to provide a complete picture of the methodology used.

The growing period was calculated for each of the 755 soil map units using the above criterion, along with various other agroclimatic variables such as:

1) Julian date of the start and end of the growing season
2) the length of the growing season (days)
3) the 24 hr mean, maximum, minimum and mean daytime temperatures during the growing season ($^{o}C$)
4) degree days greater than 5, 10 and 15$^{o}C$
5) corn heat units
6) mean windspeed (cm $sec^{-1}$)
7) mean vapour pressure (mb)
8) total precipitation (mm)
9) mean daily incoming global solar radiation ($ca/cm^{-2}day^{-1}$)
10) mean and total potential evapotranspiration during the growing season (mm)
11) total actual evapotranspiration during the growing season (mm)
12) total soil moisture deficit during the growing season (mm)
13) total available soil moisture at the end of the growing season (mm)
14) field workability at the end of the growing season.

The methods used in evaluating the above variables are outlined briefly in the following section, but more detailed descriptions for the more complicated variables are given in a separate report (Stewart, 1980).

Annual degree days above 5$^{o}C$, 10$^{o}C$ and 15$^{o}C$ were calculated for each soil map unit from the monthly maximum and minimum temperature data. These values were used to verify and correct where necessary the map unit climatic classification obtained originally from Clayton et al. (1977).

Corn heat units (CHU) were calculated on the basis of mean daily maximum and minimum temperatures using the method of Brown (1964) in the form:

$$CHU = ((T_{min}-40) + 1.85\ (T_{max}-50) - 0.026\ (T_{max}-50)^{2})/2 \times GSL \quad (2)$$

where: $T_{max}$ and $T_{min}$ are the mean growing season daily maximum and minimum air temperatures in $^{o}F$, and GSL is the growing season length in days.

The ratio of actual evapotranspiration to potential evapotranspiration over the growing season, forming the basis of a Climatic Available Moisture Useage Index (CAMUI), was computed for each soil map unit. This index, which reflects the adequacy of available soil moisture through storage and precipitation relative to the crops moisture requirements, is essential to the calculation of crop yield losses associated with moisture restriction to the crop.

Actual and potential evapotranspiration were evaluated using a soil moisture budgeting procedure (Baier, et al, 1979). This procedure was based on monitoring the daily change in soil moisture storage over the growing season allowing for precipitation, runoff and evapotranspiration. Soil moisture holding capacities were assigned to the various soil map units on the basis of their texture such that sandy loams had a value of 100 mm; very fine sandy loam to loam, 150 mm; silt loam to clay loam, 200 mm; and silty clay loam to heavy clay, 280 mm. For the purpose of this study the soil solum was divided into a surface and subsurface zone, with transpiration and evaporation occurring from the surface zone and transpiration only from the subsurface. Crop rooting depth was restricted only by absolute moisture content.

The effect of moisture deficits on reducing crop yields was expressed through a Moisture Stress Factor (MSF). This factor combined the evapotranspiration calculation of CAMUI with a yield response factor (FAO, 1979) which related the response of individual crops to moisture deficits.

An estimate of fall workday probabilities was computed as a surrogate for harvest and quality losses due to weather. The estimation involved a soil moisture budgeting procedure that related the near surface soil moisture to farm vehicle tractability (Dyer et al., 1978). Frequency distributions of workdays, varying from one to ten out of ten days in ten day consecutive periods between May 1 and November 30 for 44 meteorological stations, were generated using daily historical data. The number of workdays required within the harvest period (a value reduced to a number from 1 to 10 that further reduces to a per cent) was obtained for each station by comparing the available growing season length with the growing season requirements of the crop. For example, if the growing season length exceeded the number of days required to mature a crop by two weeks or more it was assumed that there would be ample time available to complete the harvest, and consequently there would be little or no yield loss. This was simulated by a workday requirement (or probability level) of 5 out of a possible 10 days. Conversely, a workday requirement of 10 out of 10 days simulated the situation where the growing season length was two or more weeks short of the crops average growing season requirements. A probability level of 7 out of 10 represented the case where the growing season was within plus or minus two weeks of the crops requirements.

After assigning a workday requirement to each station the probability of achieving the workday requirement was calculated by averaging the frequency values for all 10 day periods contained in the harvest period (Dyer et al. 1978). These derived workability values were then superimposed onto the soils of Canada map and isolines were constructed. Workability values for each crop were then assigned to each soil map unit by interpolation of the mapped results.

## ii. Soil derived variables

The crop growth models in this study utilize primarily climatic variables. Experience has shown that the results of such models, although generally acceptable are often geographically incorrect. This happens because the models assume homogenous soil conditions and equal crop suitability throughout the area under study, and this is rarely the case in nature. For example, an area of soils shallow to bedrock cannot be expected to yield at the same level as a deep, well drained loam in the same climate. Further, not all crops can be grown equally well in all areas.

Insufficient data were available to examine this problem quantitatively, and thus a semi-quantitative approach was used. A large soil suitability table was developed describing the proportion of each soil map unit in three degrees of suitability for each crop. A soil related yield reduction factor (Soil Index (SI)) was then developed through examination of available yield data.

The following procedures were used in the development of the suitability table. A series of criteria were developed for rating the performance of each crop relative to varying climate and soils (Table 3). Each soil map unit was then evaluated according to these criteria by referring to the data inventory described earlier. Initially the climate of the map unit was compared with that listed for each crop in Table 3. If the climate was outside the acceptable range, the area of the entire map unit was indicated as being not suited for that crop. If the climate was acceptable then given percentages of the soil map unit area were allocated to the various suitability classes according to the percentage of the map unit area contained in various capability classes. Soil profile distribution within the map unit was then examined and adjustments in the suitability allocation were made by multiplying the proportion of the map unit in a given suitability class by the suitability of the soil profiles in the map unit. Finally the soil phase criteria were applied to give the final suitability distribution.

All soil map units in the inventory were evaluated in the above manner. The procedure minimizes subjectivity as much as possible, while at the same time taking cognizance of the variability within map units. In using capability as the prime indicator of suitability the procedure makes full use of the many single factors (slope, stoniness, and so on) which collectively result in the capability class. At the same time, it circumvents some of the problems inherent in capability by giving greater emphasis to climate, and by adjusting the ratings according to requirements of specific crops.

TABLE 3 CRITERIA FOR THE DEVELOPMENT OF THE SOIL SUITABILITY TABLE

| Crop | Climatic Range[1] | | Capability Class[2] | | Soil Profile Criteria[3] | | Soil Phase Criteria |
|---|---|---|---|---|---|---|---|
| | Temp. Class | Moisture Class | Well Suited | Suited | Well Suited | Suited | |
| Wheat | 3.1 Cryoboreal, cold to 5.1 Mesic, mild | n. Subarid to d. Perhumid | 1,2 | 3,4 | All Chernozemic except Brown<br>All Solods except Brown<br>Gray Brown Luvisol<br>Melanic Brunisol<br>Eutric Brunisol | Brown Chernozemic<br>Brown Solod<br>All Solonetz<br>Gray Luvisols<br>Humic Gleysol<br>Dystric Brunisols<br>Cumulic Regosol | 1. Downgraded one class for climate with maritime influence |
| Maize (corn) | 3.2-4.1 Cryoboreal moderately cold, Boreal cool to 5.2 Mesic, moderately warm | f. Subhumic to d. Perhumid | 1,2 | 3 | Black Chernozemic (humid)<br>Gray Brown Luvisol<br>Melanic Brunisol<br>Humic Gleysol | Black Chernozemic (subhumid)<br>Solod (humid)<br>Orthic Gleysol<br>Dystric Brunisol<br>Eutric Brunisol<br>Regosol (humid) | 1. Strongly calcareous downgrade one class<br>2. Very strongly calcareous, not suited<br>3. Downgrade one class for sandy texture |
| Soybean | 5.1 Mesic, mild to 5.2 Mesic, mod. | e. Humid to d. Perhumid | 1,2 | 3 | Gray Brown Luvisol<br>Melanic Brunisol<br>Humic Gleysol | Orthic Gleysol<br>Dystric Gleysol<br>Eutric Gleysol | 1. Similar to maize<br>2. Downgrade one class for climate with maritime influence |
| Potato | 3.2 Cryoboreal, moderately cold to 5.1 Mesic, mild | f. Subhumid to d. Perhumid | 1,2 | 3 | Black Chernozemic (humid)<br>Gray Brown Luvisol<br>Melanic Brunisol<br>Eutric Brunisol<br>Podzol (humid) | Black Chernozemic (subhumid)<br>Solod (humid)<br>Humic Gleysol<br>Dystric Brunisol<br>Regosol (humid) | 1. Strongly calcareous, downgrade one class<br>2. Very strongly calcareous, not suited<br>3. Rolling and strongly rolling topography, not suited |
| Phaseolus Bean | 4.1 Boreal, cool to 5.2 Mesic moderately warm | f. Subhumid to d. Perhumid | 1,2 | 3 | Black Chernozemic<br>Gray Brown Luvisol<br>Melanic Brunisol<br>Eutric Brunisol | Black Chernozemic (subhumid)<br>Humic Gleysol<br>Dystric Brunisol<br>Regosol (humid) | 1. Similar to potato |

All unlisted classes in all columns are assigned to the "not suited" class.

Three soil suitability classes were used: 1) well suited - soils with no (or minor) limitation for the production of the crop under consideration; 2) suited - soils with moderate limitations that markedly affect production of the crop but not to the extent of making the land unsuited; 3) Not suited - soils with major limitations making production not possible, or at best, very limited.

3 profiles listed are those cited in Table 2 (Clayton et al., 1977) and do not represent all profiles recognized in the Canadian system of soil classification.

The soil suitability table was central to the calculation of production potentials for the individual crops. Map units designated as being not suited were eliminated from the calculation even though the climate in those areas may have been ideal for that crop. At the same time, map units designated in varying degrees of suitability, e.g. 10 per cent well suited, 40 per cent suited and 50 per cent not suited, had the total production potential adjusted to reflect the soil variability.

Adjustment of crop yield due to soil factors was done by means of a simple yield reduction factor or Soil Index (SI). The index was developed by reviewing available literature on crop yields relative to soil capability (Hutcheon, et al., 1964; Hoffman, 1971; Shields and Ferguson, 1975; Halstead, 1978; Kraft and Senkiw, 1979). These data showed that although the indices vary considerably with the type of data used (and consequently the author), the crop under consideration and the management inputs involved, a general decrease in yield of 25 per cent could be expected for an area designated as suited as compared to well suited. Because insufficient data were available to develop indices for individual crops, the value of 25 per cent was applied uniformly for all crops. Yield reductions, of course, were not made for areas designated as well suited.

## 2.3 CROP YIELD CALCULATIONS

The calculation of crop yield was done in a step-wise fashion. Initially, temperature and precipitation criteria for each crop (Table 4) were compared with climate conditions in each soil map unit. This identified those map units outside the acceptable crop climatic ranges and eliminated them from further yield calculations. When this was completed, constraint-free and anticipated yields estimates were calculated for each remaining soil map unit.

TABLE 4. TEMPERATURE AND PRECIPITATION CRITERIA FOR CROPS USED IN THE STUDY

| | | |
|---|---|---|
| For all Crops: | - | GSL $\geq$ 75 days |
| Corn, soybean | - | CHU $\geq$ 2500<br>Tmean $\geq$ 14.0°C<br>Precip. $\geq$ 250 mm |
| Wheat | - | Tmean > 12.0°C |
| Phaseolus bean | - | Degday (>5°C) >1000 |
| Potato | - | Precip. > 250 mm |

GSL - growing season length; CHU - corn heat units; Tmean - mean growing season air temperature; Precip - total precipitation during growing season; Degday - degree days using 5°C as the base.

### 2.3.1 Constraint-Free Yield Estimation

Constraint-free yield is the net plant dry matter production (net biomass production), or dry matter yield, of the harvestable portion of a crop that can be produced under given climatic conditions in the absence of all yield reducing factors. This can also be viewed as genetic potential or agroclimatic potential, since the values approximate the upper limit of crop performance under given condition of radiation and temperature and the extent to which these can be utilized by the genetic resources of the crop in question.

The FAO (1978) procedure utilizes the deWit (1965) photosynthesis model to calculate constraint-free yields. Net biomass production is calculated taking into account a) the gross biomass production capacity of the crop as influenced by the crops response through photosynthesis to temperature and radiation; and b) respiration losses as influenced by temperature. The model assumes a sigmoidal cumulative growth curve with development incremented up to the number of days required to mature the crop or the soil map unit growing season length, whichever is the smaller. The equation used to estimate the net biomass production ($B_n$) is expressed as:

$$B_n = 0.36\ b_{gm} / (1/N - 0.25\ C_t), \qquad (3)$$

where: $b_{gm}$ is the gross biomass production when the leaf area index is $\geq 5$ (full cover), N is the number of days required to mature a crop, and $C_t$ is a maintenance respiration coefficient.

Crop dry matter yields ($B_y$) were then derived from

$$B_y = B_n \times H_i, \qquad (4)$$

where: $H_i$ is the harvest index defined as that fraction of the net biomass production of a crop that is economically useful (e.g., grain in cereals). Values for $H_i$ were taken from FAO (1978).

### 2.3.2 Anticipated Yield Estimation

The above section describes briefly the calculation of constraint-free or genetic potential yields. These values, however, do not consider the effect of natural yield reducing factors such as climatic variability, weeds, pests and diseases, field workability or inadequate soil tilth and fertility. These factors must be considered if agronomically attainable yields are to be calculated.

Anticipated yield is the yield obtained after all soil and climatic constraint (yield reducing factors) have been considered. In this study attention was given to those factors which could be quantitatively expressed. The Moisture Stress Factor (MSF) was used to reduce yield due to moisture deficits, the Workability Factor (WF) accounted for harvest losses due to climate, and the Soil Index (SI) was used to depress yields due to inferior soil quality (all factors were explained briefly in earlier sections). The equation for anticipated yields ($B_{ya}$) then became

$$B_{ya} = B_y \times MSF \times WF \times SI. \qquad (5)$$

A thorough search of the literature failed to produce sufficient data for further refinement of equation 5). Relative to weeds for example, the best estimates (W. Saidak, personal communication) would indicate a uniform 15 per cent reduction for all crops for all regions of Canada. Similar estimates were available for other factors but in the final analyses it was decided that these would not be included. Such factors have a minimal effect in a geographic study of this nature, and their effect is probably insignificant compared to the moisture, workability and soil factors mentioned above.*

## 2.4 LAND SUITABILITY CLASSIFICATION

Values for constraint-free and anticipated yields for each soil map unit rated as suitable for the production of a given crop were entered into the data base management system for the project. This put the data in a very open ended, flexible form from which a large number of reports and maps could be produced. The problem then became one of how best to condense the vast numbers of data into a meaningful package. Following the requirements of FAO, the procedure chosen was the development of a quantitative crop suitability classification. However, it should be emphasized that this is only one of many possible ways that the data could be expressed.

The suitability classification was a simple sort/select procedure based on constraint-free and anticipated yield values. The data files were searched and the maximal constraint-free yield value for each crop was selected as the base level. The anticipated yield for each soil map unit was then compared with the base level as a simple percentage. The equation was:

$$LSV = \frac{B_{yai}}{B_{ym}} \times 100 \qquad (6)$$

where: LSV is the land suitability value, $B_{yai}$ is the anticipated yield for soil map unit i and $B_{ym}$ is the maximal constraint-free yield for that crop in the country. Land suitability values were then classified into one of six land suitability classes:

* Plant diseases can significantly affect crop quality and production in specific areas in certain years, but quantitative information on these relationships was not available.

Very suitable - areas capable of yielding 80 per cent or more of the maximal attainable yield in the country

Suitable - areas capable of yielding 60 to 80 per cent of the maximal attainable yield in the country

Moderately suitable - areas capable of yielding 40 to 60 per cent of the maximal attainable yield in the country

Marginally suitable - areas capable of yielding 20 to 40 per cent of the maximal attainable yield in the country

Not suitable - areas capable of yielding less than 20 per cent of the maximal attainable yield in the country.

No potential - areas where the crop will not mature or cannot be grown because of soil conditions.

Inherent in the land suitability classes are the assumptions that constraint-free yields are approximately equivalent to maximal attainable (genetic potential) yields, and these can be achieved under ideal conditions of soils, climate and management somewhere in the country. A high standard of agronomic practices, utilizing a mechanized system of agriculture is assumed. Fertilizer applications are timely and according to recommendations, weeds, pests and diseases are adequately controlled, and soil quality is not allowed to deteriorate. Economic and other non-environmental factors in crop production are not considered in the classification.

The application of the above procedure was straight forward for soil map units that are relatively homogenous with respect to their soil resources and have only one level of anticipated yield. The more common situation, however, is one where various proportions of the map unit have one of two possible anticipated yield levels. In these instances the higher of the two levels was selected to represent the unit.

The land suitability classification provides estimates of agronomically attainable yields for all map units in the Soils of Canada map relative to the best areas in the country for the cultivation of that particular crop. These data, together with area calculations and selected other data from the assembled data base, are the subject of subsequent sections in this report.

# 3. RESULTS

## 3.1 CLIMATIC INVENTORY

Major Thermal climatic regimes have been inventoried for temperature and moisture conditions that limit the five crops considered in this study. The thermal characteristics used to define the climatic divisions are described in Table 5 and the area of each division by growing season length is shown in Table 6.

A classification similar to that used to characterize the soil climates of Canada (Clayton et al., 1977) was employed to arrive at the major thermal divisions for Canada. Utilizing mean air temperature the annual degree days above 5, 10 and 15°C were computed for each soil unit. These values were compared to the various degree day criteria listed in Table 5 and accordingly each soil unit was assigned to one of the five major thermal zones. The geographic location and extent of each zone with isolines of growing season lengths in 15 day intervals, is shown on the map which accompanies this report (see back cover).

TABLE 5 THERMAL CHARACTERISTICS OF THE MAJOR CLIMATIC DIVISIONS IN CANADA

| | Arctic | Subarctic | Cryoboreal | Boreal | Mesic |
|---|---|---|---|---|---|
| Average Growing Season Length | 0 | <75 | <105 | <135 | >135 |
| DEG DAYS 5°C | 50 | <525 | <1250 | <1725 | >1725 |
| DEG DAYS 10°C | - | <85 | <550 | <875 | >875 |
| DEG DAYS 15°C | - | - | <125 | <300 | >225 |
| Corn Heat Units | - | <800 | <2100 | <2750 | >2750 |
| Mean Temperature | - | <12.0°C | <15.5°C | <17.0°C | >16.0°C |
| Mean Max Temperature | - | <19.0°C | <23.0°C | <26.5°C | >22°C |
| Mean Min Temperature | - | <7.5°C | <9.5°C | <11.0°C | >9.0°C |

In general it is evident from Table 5 that progressing from the Arctic through to the Mesic climate zones, both the growing season length and thermal characteristics increase. Also it is evident that only the Cryoboreal, Boreal and Mesic zones have agricultural potential, whereas the Subarctic and Arctic zones, with growing seasons of less than 75 days, have no capability for agricultural production.

The area of each of the major climatic zones for various growing season lengths is given in Table 6. The Arctic and Subarctic zones, which are climatically unsuitable for agriculture, occupy 42 per cent of the land mass area of Canada. With the addition of the

TABLE 6 TOTAL AREA of SOIL UNITS by MAJOR CLIMATIC ZONE and GROWING SEASON LENGTH (ha x 1000)

| | Growing Season Length (Days) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | 180 | Total |
| Arctic | 170631 | 112571 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 283202 |
| Subarctic | 5029 | 94872 | 2365 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 102266 |
| Cryoboreal | 810 | 68992 | 57014 | 157229 | 104827 | 3865 | 1079 | 3539 | 1984 | 996 | 400335 |
| Boreal | 0 | 0 | 0 | 7081 | 66195 | 15936 | 5197 | 0 | 1855 | 1022 | 97286 |
| Mesic | 0 | 0 | 0 | 0 | 0 | 0 | 5356 | 4594 | 1069 | 0 | 11019 |
| Total | 176470 | 276435 | 59379 | 164310 | 171022 | 19801 | 11632 | 8133 | 4908 | 2018 | |

NUMBER OF SOIL MAP UNITS CONTAINED IN EACH GROWING SEASON LENGTH RANGE

| | Growing Season Length (Days) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1-74 | 75-89 | 90-109 | 105-119 | 120-134 | 135-149 | 150-164 | 165-180 | 180 |
| Arctic | 112 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Subarctic | 4 | 34 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cryoboreal | 2 | 30 | 38 | 151 | 63 | 14 | 8 | 9 | 5 | 8 |
| Boreal | 0 | 0 | 0 | 27 | 107 | 41 | 20 | 0 | 2 | 5 |
| Mesic | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 23 | 2 | 0 |

Cryoboreal area with a growing season length of less than 75 days, the climatically unsuited area increases to 51 per cent. Fifty seven per cent of the country has a growing season of less than 90 days. These data represent those areas receiving sufficient thermal energy to support field crops, but do not include areas with soil or moisture limitations. The inclusion of soil and moisture limitations as yield reducing constraints increases the above unsuitable area to over 90 per cent of the total.

Table 7 shows the range of various climatic parameters by major climatic division and by growing season length. These data indicate that growing season length and degree day calculations for the Cryoboreal and Boreal zones can exceed the mean values (Table 5) by a large margin. This is due partly to the degree day calculation criteria used to establish the major climatic divisions. In assigning a climatic classification to each soil unit the computed annual degree days (DD) values for >5, >10 and >15$^{o}$C had to exceed each of the values listed in Table 5. If only one or two of the three were exceeded the soil map unit climatic classification was assigned to the colder class. For example, Table 8 shows the growing season length and degree day estimates for soil units Gl 17 and Gl 7 which approximates the locations of Vancouver and Windsor respectively. It can be seen that for Gl 7 the degree days (DD) values in all cases exceed the Mesic Climatic zone requirements listed in Table 5, whereas for Gl 17, although the DD >5$^{o}$C value exceeds that of the Mesic zone requirements, both DD >10 and DD >15 are less than the values expressed in Table 5. In this case the map unit Gl 17 was assigned to the Boreal Climatic zone.

All mean growing season information computed for each soil unit capable of supporting one or more of the crops considered in this study are shown on the microfiche accompanying this report (see back cover).

TABLE 7

MAXIMUM AND MINIMUM VALUES OF GROWING SEASON CLIMATIC INFORMATION FOR THE MAJOR CLIMATIC ZONES BY GROWING SEASON LENGTH

| CLIMATIC ZONE | CLIMATIC DATA | GROWING SEASON LENGTH (DAYS) 0 MIN | 0 MAX | 1-74 MIN | 1-74 MAX | 75-89 MIN | 75-89 MAX | 90-104 MIN | 90-104 MAX | 105-119 MIN | 105-119 MAX | 120-134 MIN | 120-134 MAX | 135-149 MIN | 135-149 MAX | 150-164 MIN | 150-164 MAX | 165-179 MIN | 165-179 MAX | >180 MIN | >180 MAX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUBARCTIC | TMEAN (C) | | | 7.8 | 13.2 | | | | | | | | | | | | | | | | |
| | TMAX (C) | | | 10.4 | 18.9 | | | | | | | | | | | | | | | | |
| | TMIN (C) | | | 5.8 | 7.4 | | | | | | | | | | | | | | | | |
| | CANUI( DIM) | | | 0.39 | 0.86 | | | | | | | | | | | | | | | | |
| | RADIATION (CAL) | | | 313 | 481 | | | | | | | | | | | | | | | | |
| | RAINFALL (MM) | | | 3 | 207 | | | | | | | | | | | | | | | | |
| | PE (MM) | | | 8 | 183 | | | | | | | | | | | | | | | | |
| | DEGREE DAYS >5C | 51 | 488 | 109 | 537 | | | | | | | | | | | | | | | | |
| | DEGREE DAYS >10C | 35 | 52 | 6 | 140 | | | | | | | | | | | | | | | | |
| | DEGREE DAYS >15C | | | | | | | | | | | | | | | | | | | | |
| | CORN HEAT UNITS | 6 | 784 | 47 | 871 | | | | | | | | | | | | | | | | |
| | NO. OF MAP UNITS | 63 | | 49 | | | | | | | | | | | | | | | | | |
| CRYOBOREAL | TMEAN (C) | | | 11.1 | 14.7 | 11.0 | 14.9 | 11.8 | 15.4 | 12.5 | 15.2 | 13.1 | 13.5 | 12.5 | 12.8 | 12.3 | 12.9 | 11.6 | 13.5 | 11.0 | 12.8 |
| | TMAX (C) | | | 16.3 | 23.3 | 15.5 | 23.1 | 15.9 | 22.7 | 16.6 | 21.7 | 16.8 | 18.4 | 16.8 | 17.6 | 16.2 | 17.3 | 13.3 | 18.1 | 13.1 | 16.9 |
| | TMIN (C) | | | 5.1 | 7.4 | 6.1 | 8.8 | 6.5 | 9.4 | 7.5 | 9.4 | 7.8 | 9.5 | 7.7 | 8.6 | 8.2 | 8.7 | 8.3 | 9.3 | 8.6 | 9.3 |
| | CANUI( DIM) | | | 0.45 | 0.85 | 0.52 | 0.87 | 0.49 | 0.89 | 0.54 | 0.90 | 0.85 | 0.87 | 0.88 | 0.91 | 0.88 | 0.91 | 0.70 | 0.90 | 0.90 | 0.92 |
| | RADIATION (CAL) | | | 389 | 572 | 386 | 542 | 378 | 521 | 376 | 466 | 384 | 425 | 359 | 373 | 354 | 450 | 337 | 434 | 352 | 419 |
| | RAINFALL (MM) | | | 26 | 243 | 87 | 274 | 106 | 431 | 128 | 440 | 307 | 434 | 526 | 629 | 409 | 733 | 393 | 1046 | 678 | 1202 |
| | PE (MM) | | | 35 | 217 | 126 | 343 | 141 | 359 | 189 | 393 | 288 | 329 | 232 | 288 | 273 | 342 | 242 | 457 | 323 | 407 |
| | DEGREE DAYS >5C | 599 | 697 | 568 | 1179 | 959 | 1225 | 705 | 1290 | 944 | 1247 | 1056 | 1161 | 1167 | 1271 | 1106 | 1331 | 1100 | 1595 | 1220 | 1537 |
| | DEGREE DAYS >10C | 60 | 163 | 45 | 416 | 76 | 455 | 153 | 549 | 267 | 556 | 379 | 436 | 355 | 416 | 362 | 462 | 243 | 608 | 284 | 526 |
| | DEGREE DAYS >15C | | | | | 15 | 36 | 6 | 111 | 8 | 114 | 1 | 28 | | | | | 22 | 22 | | |
| | CORN HEAT UNITS | 943 | 1133 | 871 | 1953 | 827 | 2031 | 1094 | 2087 | 1494 | 2080 | 1703 | 1903 | 1866 | 2051 | 1883 | 2162 | 1552 | 2599 | 1706 | 2460 |
| | NO. OF MAP UNITS | 4 | | 33 | | 38 | | 91 | | 31 | | 6 | | 4 | | 6 | | 5 | | 8 | |
| BOREAL | TMEAN (C) | | | | | 15.4 | 15.4 | 14.8 | 16.7 | 14.9 | 16.9 | 14.4 | 16.8 | 13.9 | 16.3 | 13.9 | 14.6 | 14.2 | 14.6 | 13.0 | 15.0 |
| | TMAX (C) | | | | | 23.9 | 23.9 | 21.7 | 26.2 | 20.9 | 25.7 | 19.1 | 23.3 | 18.5 | 23.3 | 18.7 | 19.8 | 18.9 | 19.2 | 17.2 | 20.6 |
| | TMIN (C) | | | | | 7.0 | 7.0 | 7.3 | 8.7 | 7.8 | 10.1 | 8.8 | 10.4 | 8.6 | 10.7 | 8.9 | 9.7 | 9.2 | 10.3 | 8.8 | 10.4 |
| | CANUI( DIM) | | | | | 0.68 | 0.68 | 0.44 | 0.84 | 0.39 | 0.91 | 0.70 | 0.93 | 0.44 | 0.93 | 0.73 | 0.91 | 0.86 | 0.88 | 0.48 | 0.90 |
| | RADIATION (CAL) | | | | | 529 | 529 | 481 | 535 | 484 | 531 | 399 | 508 | 364 | 480 | 376 | 445 | 434 | 449 | 403 | 442 |
| | RAINFALL (MM) | | | | | 176 | 176 | 86 | 303 | 101 | 388 | 191 | 433 | 172 | 469 | 428 | 959 | 316 | 496 | 271 | 1145 |
| | PE (MM) | | | | | 381 | 381 | 397 | 498 | 299 | 559 | 318 | 511 | 313 | 497 | 349 | 424 | 461 | 527 | 460 | 566 |
| | DEGREE DAYS >5C | | | | | 1309 | 1309 | 1253 | 1682 | 1252 | 1749 | 1316 | 1677 | 1407 | 1799 | 1561 | 1618 | 1770 | 1819 | 1813 | 2000 |
| | DEGREE DAYS >10C | | | | | 535 | 535 | 503 | 788 | 531 | 842 | 569 | 868 | 583 | 870 | 641 | 683 | 758 | 819 | 643 | 917 |
| | DEGREE DAYS >15C | | | | | 71 | 71 | 50 | 186 | 61 | 257 | 83 | 298 | 65 | 253 | 84 | 117 | 104 | 168 | 107 | 190 |
| | CORN HEAT UNITS | | | | | 2136 | 2136 | 2078 | 2652 | 2068 | 2769 | 2177 | 2757 | 2313 | 2935 | 2591 | 2671 | 2908 | 2984 | 2898 | 3289 |
| | NO. OF MAP UNITS | | | | | 1 | | 87 | | 139 | | 49 | | 21 | | 3 | | 2 | | 5 | |
| HEBIC | TMEAN (C) | | | | | | | | | | | | | 16.2 | 16.8 | 16.4 | 17.1 | 17.3 | 17.5 | | |
| | TMAX (C) | | | | | | | | | | | | | 21.9 | 23.9 | 22.0 | 22.8 | 22.9 | 24.5 | | |
| | TMIN (C) | | | | | | | | | | | | | 8.9 | 10.9 | 10.3 | 11.6 | 10.5 | 11.8 | | |
| | CANUI( DIM) | | | | | | | | | | | | | 0.64 | 0.93 | 0.89 | 0.93 | 0.19 | 0.89 | | |
| | RADIATION (CAL) | | | | | | | | | | | | | 429 | 500 | 420 | 472 | 426 | 469 | | |
| | RAINFALL (MM) | | | | | | | | | | | | | 133 | 446 | 269 | 446 | 115 | 404 | | |
| | PE (MM) | | | | | | | | | | | | | 422 | 547 | 457 | 502 | 530 | 661 | | |
| | DEGREE DAYS >5C | | | | | | | | | | | | | 1741 | 1905 | 1863 | 2100 | 2214 | 2230 | | |
| | DEGREE DAYS >10C | | | | | | | | | | | | | 872 | 1000 | 968 | 1158 | 1234 | 1241 | | |
| | DEGREE DAYS >15C | | | | | | | | | | | | | 344 | 351 | 313 | 452 | 488 | 490 | | |
| | CORN HEAT UNITS | | | | | | | | | | | | | 2883 | 3139 | 3085 | 3458 | 3572 | 3631 | | |
| | NO. OF MAP UNITS | | | | | | | | | | | | | 34 | | 23 | | 2 | | | |

TABLE 8. CLIMATIC CLASSIFICATION FOR SOIL UNITS Gl 7 AND Gl 17, APPROXIMATELY THE LOCATIONS OF WINDSOR, ONTARIO AND VANCOUVER, BRITISH COLUMBIA

| Growing Season Length | Gl 7 | Gl 17 |
|---|---|---|
| Growing Season Length | 169 | 178 |
| Degree Days >5 | 2214 | 1770 |
| Degree Days >10 | 1234 | 750 |
| Degree Days >15 | 498 | 104 |
| Climatic Classification | Mesic | Boreal |

## 3.2 SOIL INVENTORY

Table 9 shows mean values of various climatic parameters by soil Great Group and growing season length. The values represent the growing period only (not the entire year), and are grouped according to the soil taxonomic identifier used for each soil map unit in the Soils of Canada (Clayton et al., 1977).

In general the data show a strong coincidence between climate and soils, particularly for those units where climatically controlled variables are used as diagnostic criteria at high levels of taxonomy. For example, the Brown, Dark Brown, Black and Dark Gray Chernozemic, Brown and Black Solonetz, Black Solod, Gray Brown Luvisol and Melanic Brunisols group into compact units with only a limited range of growing season length and climatic characteristics. Such soil groups are useful for edaphic or ecological studies. For those soils with a strong zonal expression (such as the Chernozemic soils) the data show amongst other things the general decrease in temperature and increase in moisture efficiency in progressing from south to north, even though precipitation remains relatively constant. They also identify various specific soil groups, such as the long season Chernozemic soils found only in British Columbia, as being edaphically quite different from the Chernozemic soils of the Canadian Great Plains. Other soil groups such as Gray Luvisols, Humo-Ferric Podzols, Eutric and Dystric Brunisols and Humic and Orthic Gleysols show a wide diversity of climatic characteristics, and such groups have limited application for any edaphic or crop productivity study.

The soil groups with the highest potential for agriculture are Gray Brown Luvisols and Melanic Brunisols. These are warm soils with fairly long growing seasons and high moisture use indices (CAMUI). These soils occupy less than 1 per cent of the total land surface of the country. The Chernozemic soils, Solods, Humic and Orthic Gleysols and the Gray Luvisols with more than 90 days growing season length have intermediate agricultural potential. These are comparatively dry soils or they are found in cool climatic areas. The Gleysols generally must be drained before they can be used for agriculture. The longer season (greater than 90 days growing season length) Podzols and Dystric Brunisols have some agricultural potential, but generally they are used for forage crops or potatoes. Collectively these soils occupy somewhat less than 10 per cent of the country.

The soils with the lowest agricultural potential are Solonetz, Eutric Brunisols, and Regosols. These soils are either excessively saline, too cold or suffer from an imbalance of plant nutrients. They are commonly used for forages or rangeland. The longer season Fibrisols (organic soils) have considerable potential for specialty crops, but must first be developed. The remaining soil groups (Cryic Orthic Gleysol, Cryic Fibrisol and Rockland) as well as all other groups with less than 90 days growing season length, have minimal or no agricultural potential.

TABLE 9

MAXIMUM AND MINIMUM VALUES OF GROWING SEASON CLIMATIC INFORMATION FOR THE MAJOR SOIL GROUPS BY GROWING SEASON LENGTH

| SOIL GROUP | CLIMATIC DATA | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX |
| BROWN CHERNOZEMIC | TMEAN (C) | | | | 15.6 16.1 | 16.0 16.6 | | | | 17.5 17.5 | |
| | TMAX (C) | | | | 23.3 23.6 | 23.5 24.1 | | | | 28.5 28.5 | |
| | CAMUI( DIM) | | | | 0.88 0.90 | 0.88 0.97 | | | | 0.19 0.19 | |
| | RADIATION (CAL) | | | | 519 528 | 514 530 | | | | 469 469 | |
| | RAINFALL (MM) | | | | 161 195 | 171 208 | | | | 115 115 | |
| | PE (MM) | | | | 412 439 | 448 559 | | | | 661 661 | |
| | DEGREE DAYS >5C | | | | 1349 1418 | 1469 1599 | | | | 2236 2236 | |
| | DEGREE DAYS >10C | | | | 585 651 | 678 788 | | | | 1241 1241 | |
| | DEGREE DAYS >15C | | | | 104 156 | 168 227 | | | | 488 488 | |
| | CORN HEAT UNITS | | | | 2227 2311 | 2372 2609 | | | | 3572 3572 | |
| | NO. OF MAP UNITS | | | | 7 | 17 | | | | 1 | |
| DARK BROWN CHERNOZEMIC | TMEAN (C) | | | | 15.3 16.7 | 15.6 16.5 | | 16.6 16.6 | | | |
| | TMAX (C) | | | | 22.6 26.2 | 23.1 23.9 | | 23.9 23.9 | | | |
| | TMIN (C) | | | | 7.3 8.7 | 8.2 9.2 | | 8.9 8.9 | | | |
| | CAMUI( DIM) | | | | 0.86 0.75 | 0.85 0.81 | | 0.88 0.88 | | | |
| | RADIATION (CAL) | | | | 494 535 | 484 531 | | 508 508 | | | |
| | RAINFALL (MM) | | | | 123 211 | 185 239 | | 133 133 | | | |
| | PE (MM) | | | | 342 458 | 488 503 | | 493 493 | | | |
| | DEGREE DAYS >5C | | | | 1232 1682 | 1628 1954 | | 1794 1794 | | | |
| | DEGREE DAYS >10C | | | | 518 788 | 621 756 | | 879 879 | | | |
| | DEGREE DAYS >15C | | | | 77 186 | 128 212 | | 288 288 | | | |
| | CORN HEAT UNITS | | | | 2041 2652 | 2348 2542 | | 2918 2918 | | | |
| | NO. OF MAP UNITS | | | | 16 | 16 | | 1 | | | |
| BLACK CHERNOZEMIC | TMEAN (C) | | | 14.9 14.9 | 14.9 15.9 | 13.9 16.7 | 16.5 16.8 | | 16.6 16.6 | | |
| | TMAX (C) | | | 22.6 22.6 | 21.8 23.6 | 20.6 25.6 | 22.8 23.3 | | 22.6 22.6 | | |
| | TMIN (C) | | | 7.3 7.3 | 7.8 8.7 | 7.5 10.1 | 10.2 10.6 | | 10.3 10.3 | | |
| | CAMUI( DIM) | | | 0.78 0.78 | 0.52 0.82 | 0.57 0.81 | 0.72 0.79 | | 0.89 0.89 | | |
| | RADIATION (CAL) | | | 582 582 | 472 532 | 451 513 | 484 488 | | 472 472 | | |
| | RAINFALL (MM) | | | 167 167 | 162 234 | 157 270 | 272 289 | | 269 269 | | |
| | PE (MM) | | | 383 383 | 346 458 | 297 482 | 465 511 | | 582 582 | | |
| | DEGREE DAYS >5C | | | 1183 1183 | 1247 1621 | 1228 1613 | 1585 1677 | | 1959 1959 | | |
| | DEGREE DAYS >10C | | | 637 637 | 696 834 | 651 809 | 792 860 | | 1036 1036 | | |
| | DEGREE DAYS >15C | | | 36 36 | 51 136 | 8 257 | 249 290 | | 368 368 | | |
| | CORN HEAT UNITS | | | 1959 1959 | 2070 2336 | 2058 2652 | 2614 2757 | | 3180 3180 | | |
| | NO. OF MAP UNITS | | | 1 | 16 | 22 | 6 | | 1 | | |
| DARK GRAY CHERNOZEMIC | TMEAN (C) | | | | 16.0 15.7 | 15.7 16.5 | 16.4 16.7 | | | | |
| | TMAX (C) | | | | 20.7 22.9 | 22.5 25.6 | 22.6 23.3 | | | | |
| | TMIN (C) | | | | 7.3 8.6 | 7.8 9.9 | 10.1 10.2 | | | | |
| | CAMUI( DIM) | | | | 0.69 0.84 | 0.85 0.81 | 0.73 0.87 | | | | |
| | RADIATION (CAL) | | | | 457 492 | 458 518 | 475 488 | | | | |
| | RAINFALL (MM) | | | | 153 208 | 181 255 | 270 291 | | | | |
| | PE (MM) | | | | 278 376 | 377 468 | 455 488 | | | | |
| | DEGREE DAYS >5C | | | | 1097 1381 | 1339 1968 | 1562 1626 | | | | |
| | DEGREE DAYS >10C | | | | 383 683 | 686 775 | 773 819 | | | | |
| | DEGREE DAYS >15C | | | | 60 121 | 113 238 | 234 264 | | | | |
| | CORN HEAT UNITS | | | | 1838 2216 | 2219 2583 | 2578 2672 | | | | |
| | NO. OF MAP UNITS | | | | 8 | 9 | 5 | | | | |

TABLE 9 (cont)

MAXIMUM AND MINIMUM VALUES OF GROWING SEASON CLIMATIC INFORMATION FOR THE MAJOR SOIL GROUPS BY GROWING SEASON LENGTH

| SOIL GROUP | CLIMATIC DATA | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX |
| BLACK SOLOD | TMEAN (C) | | | | 14.6 14.7 | | | | | | |
| | TMAX (C) | | | | 21.2 21.7 | | | | | | |
| | TMIN (C) | | | | 7.5 7.7 | | | | | | |
| | CANUI( DIM) | | | | 0.81 0.83 | | | | | | |
| | RADIATION (CAL) | | | | 466 470 | | | | | | |
| | RAINFALL (MM) | | | | 191 210 | | | | | | |
| | PE (MM) | | | | 329 333 | | | | | | |
| | DEGREE DAYS >5C | | | | 1180 1230 | | | | | | |
| | DEGREE DAYS >10C | | | | 485 487 | | | | | | |
| | DEGREE DAYS >15C | | | | 6 37 | | | | | | |
| | CORN HEAT UNITS | | | | 1967 2067 | | | | | | |
| | NO. OF MAP UNITS | | | | 3 | | | | | | |
| GRAY BROWN LUVISOL | TMEAN (C) | | | | | | | 16.2 16.6 | 16.6 17.1 | | |
| | TMAX (C) | | | | | | | 22.2 22.8 | 22.5 22.8 | | |
| | TMIN (C) | | | | | | | 10.2 10.7 | 10.8 11.6 | | |
| | CANUI( DIM) | | | | | | | 0.77 0.81 | 0.78 0.82 | | |
| | RADIATION (CAL) | | | | | | | 461 465 | 438 456 | | |
| | RAINFALL (MM) | | | | | | | 334 364 | 364 419 | | |
| | PE (MM) | | | | | | | 440 465 | 460 507 | | |
| | DEGREE DAYS >5C | | | | | | | 1761 1850 | 1980 2108 | | |
| | DEGREE DAYS >10C | | | | | | | 872 962 | 997 1155 | | |
| | DEGREE DAYS >15C | | | | | | | 258 319 | 339 452 | | |
| | CORN HEAT UNITS | | | | | | | 2882 3058 | 3137 3458 | | |
| | NO. OF MAP UNITS | | | | | | | 8 | 10 | | |
| BROWN SOLONETZ | TMEAN (C) | | | | 15.5 15.9 | 16.1 16.5 | | | | | |
| | TMAX (C) | | | | 22.0 23.5 | 23.4 23.9 | | | | | |
| | TMIN (C) | | | | 8.1 8.8 | 8.6 9.2 | | | | | |
| | CANUI( DIM) | | | | 0.51 0.63 | 0.65 0.65 | | | | | |
| | RADIATION (CAL) | | | | 506 531 | 503 527 | | | | | |
| | RAINFALL (MM) | | | | 150 199 | 171 214 | | | | | |
| | PE (MM) | | | | 398 433 | 436 503 | | | | | |
| | DEGREE DAYS >5C | | | | 1345 1381 | 1435 1531 | | | | | |
| | DEGREE DAYS >10C | | | | 579 620 | 670 761 | | | | | |
| | DEGREE DAYS >15C | | | | 97 137 | 152 205 | | | | | |
| | CORN HEAT UNITS | | | | 2228 2265 | 2350 2510 | | | | | |
| | NO. OF MAP UNITS | | | | 3 | 5 | | | | | |
| BLACK SOLONETZ | TMEAN (C) | | | 14.1 14.1 | 14.5 15.1 | 15.0 15.0 | | | | | |
| | TMAX (C) | | | 21.3 21.3 | 21.4 22.1 | 21.7 21.7 | | | | | |
| | TMIN (C) | | | 6.8 6.8 | 7.6 8.1 | 8.2 8.2 | | | | | |
| | CANUI( DIM) | | | 0.81 0.81 | 0.79 0.85 | 0.75 0.75 | | | | | |
| | RADIATION (CAL) | | | 476 476 | 469 490 | 453 453 | | | | | |
| | RAINFALL (MM) | | | 149 149 | 195 231 | 173 173 | | | | | |
| | PE (MM) | | | 283 283 | 332 372 | 362 362 | | | | | |
| | DEGREE DAYS >5C | | | 1047 1047 | 1219 1297 | 1271 1271 | | | | | |
| | DEGREE DAYS >10C | | | 345 345 | 486 541 | 537 537 | | | | | |
| | DEGREE DAYS >15C | | | | 21 78 | 68 68 | | | | | |
| | CORN HEAT UNITS | | | 1765 1765 | 2035 2163 | 2119 2119 | | | | | |
| | NO. OF MAP UNITS | | | 1 | 3 | 1 | | | | | |

TABLE 9 (cont)

MAXIMUM AND MINIMUM VALUES OF GROWING SEASON CLIMATIC INFORMATION FOR THE MAJOR SOIL GROUPS BY GROWING SEASON LENGTH

| SOIL GROUP | CLIMATIC DATA | GROWING SEASON LENGTH (DAYS) 0 | | 1-74 | | 75-89 | | 90-104 | | 105-119 | | 120-134 | | 135-149 | | 150-164 | | 165-179 | | >180 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| GRAY LUVISOL | TMEAN (C) | | | 12.5 | 14.7 | 12.9 | 16.5 | 13.0 | 16.1 | 15.0 | 16.3 | 14.5 | 16.6 | 16.9 | 16.5 | | | | | | |
| | TMAX (C) | | | 19.3 | 23.3 | 18.2 | 22.4 | 17.3 | 24.7 | 21.0 | 24.4 | 19.3 | 22.7 | 19.9 | 22.6 | | | | | | |
| | TMIN (C) | | | 5.6 | 6.8 | 6.6 | 8.8 | 7.2 | 9.1 | 7.8 | 10.1 | 9.6 | 10.1 | 10.0 | 10.1 | | | | | | |
| | CANUI( DIM) | | | 0.60 | 0.85 | 0.75 | 0.87 | 0.58 | 0.89 | 0.56 | 0.91 | 0.84 | 0.93 | 0.92 | 0.93 | | | | | | |
| | RADIATION (CAL) | | | 416 | 536 | 483 | 493 | 410 | 527 | 422 | 517 | 483 | 485 | 483 | 454 | | | | | | |
| | RAINFALL (MM) | | | 56 | 178 | 113 | 285 | 86 | 314 | 145 | 359 | 293 | 411 | 338 | 468 | | | | | | |
| | PE (MM) | | | 108 | 217 | 163 | 295 | 210 | 374 | 308 | 489 | 318 | 456 | 357 | 418 | | | | | | |
| | DEGREE DAYS >5C | 311 | 599 | 782 | 1179 | 787 | 1225 | 920 | 1535 | 1248 | 1574 | 1391 | 1566 | 1584 | 1609 | | | | | | |
| | DEGREE DAYS >10C | 60 | 60 | 163 | 416 | 248 | 435 | 295 | 685 | 537 | 755 | 593 | 776 | 674 | 853 | | | | | | |
| | DEGREE DAYS >15C | | | | | | | 13 | 129 | 85 | 226 | 97 | 236 | 148 | 253 | | | | | | |
| | CORN HEAT UNITS | 462 | 966 | 1297 | 1953 | 1290 | 2031 | 1476 | 2485 | 2060 | 2553 | 2299 | 2584 | 2687 | 2812 | | | | | | |
| | NO. OF MAP UNITS | 3 | | 11 | | 15 | | 47 | | 25 | | 6 | | 4 | | | | | | | |
| HUMO-FERRIC PODZOL | TMEAN (C) | | | 10.5 | 12.6 | 11.8 | 13.6 | 11.8 | 15.4 | 12.5 | 15.9 | 13.1 | 16.0 | 12.5 | 16.5 | 12.3 | 17.0 | 11.0 | 16.6 | 11.0 | 16.2 |
| | TMAX (C) | | | 16.6 | 19.0 | 16.5 | 19.1 | 15.9 | 22.6 | 16.6 | 23.6 | 17.6 | 22.2 | 16.8 | 25.3 | 16.2 | 22.6 | 13.3 | 18.9 | 13.1 | 18.8 |
| | TMIN (C) | | | 5.5 | 7.3 | 6.1 | 8.2 | 6.5 | 8.9 | 7.7 | 9.7 | 7.8 | 10.1 | 7.7 | 10.9 | 8.2 | 11.6 | 8.3 | 10.3 | 8.6 | 10.6 |
| | CANUI( DIM) | | | 0.59 | 0.82 | 0.70 | 0.83 | 0.69 | 0.87 | 0.62 | 0.89 | 0.81 | 0.90 | 0.88 | 0.91 | 0.73 | 0.91 | 0.86 | 0.90 | 0.58 | 0.92 |
| | RADIATION (CAL) | | | 389 | 527 | 399 | 510 | 388 | 486 | 376 | 487 | 384 | 457 | 359 | 480 | 358 | 458 | 337 | 449 | 392 | 428 |
| | RAINFALL (MM) | | | 69 | 243 | 138 | 274 | 152 | 431 | 192 | 480 | 322 | 438 | 172 | 620 | 489 | 959 | 316 | 1046 | 461 | 1282 |
| | PE (MM) | | | 75 | 188 | 126 | 236 | 141 | 339 | 189 | 398 | 288 | 481 | 232 | 497 | 273 | 497 | 242 | 527 | 323 | 566 |
| | DEGREE DAYS >5C | 329 | 329 | 675 | 882 | 627 | 866 | 755 | 1261 | 944 | 1502 | 1115 | 1648 | 1167 | 1814 | 1186 | 2083 | 1188 | 1819 | 1228 | 1892 |
| | DEGREE DAYS >10C | | | 24 | 202 | 123 | 274 | 153 | 537 | 267 | 702 | 379 | 867 | 355 | 982 | 362 | 1091 | 243 | 819 | 284 | 857 |
| | DEGREE DAYS >15C | | | | | | | 6 | 88 | 27 | 162 | 25 | 223 | 112 | 308 | 56 | 418 | 22 | 168 | 188 | 188 |
| | CORN HEAT UNITS | 455 | 455 | 654 | 1458 | 992 | 1382 | 1178 | 2098 | 1498 | 2511 | 1883 | 2724 | 1866 | 3013 | 1883 | 3382 | 1552 | 2986 | 1706 | 3072 |
| | NO. OF MAP UNITS | 1 | | 9 | | 8 | | 31 | | 30 | | 19 | | 23 | | 11 | | 6 | | 10 | |
| MELANIC BRUNISOL | TMEAN (C) | | | | | | | | | | | | | 16.2 | 16.8 | 16.6 | 17.0 | | | | |
| | TMAX (C) | | | | | | | | | | | | | 21.9 | 22.7 | 22.2 | 22.7 | | | | |
| | TMIN (C) | | | | | | | | | | | | | 10.2 | 10.9 | 10.6 | 11.3 | | | | |
| | CANUI( DIM) | | | | | | | | | | | | | 0.79 | 0.91 | 0.88 | 0.91 | | | | |
| | RADIATION (CAL) | | | | | | | | | | | | | 430 | 465 | 422 | 465 | | | | |
| | RAINFALL (MM) | | | | | | | | | | | | | 334 | 421 | 352 | 486 | | | | |
| | PE (MM) | | | | | | | | | | | | | 440 | 466 | 461 | 517 | | | | |
| | DEGREE DAYS >5C | | | | | | | | | | | | | 1741 | 1985 | 1868 | 2088 | | | | |
| | DEGREE DAYS >10C | | | | | | | | | | | | | 872 | 1008 | 965 | 1184 | | | | |
| | DEGREE DAYS >15C | | | | | | | | | | | | | 298 | 351 | 313 | 417 | | | | |
| | CORN HEAT UNITS | | | | | | | | | | | | | 2882 | 3130 | 3085 | 3368 | | | | |
| | NO. OF MAP UNITS | | | | | | | | | | | | | 13 | | 7 | | | | | |
| EUTRIC BRUNISOL | TMEAN (C) | | | 10.9 | 13.7 | 13.9 | 13.9 | 14.1 | 14.8 | 14.9 | 15.7 | | | | | | | | | | |
| | TMAX (C) | | | 16.7 | 22.1 | 19.9 | 20.3 | 20.8 | 21.1 | 21.6 | 22.4 | | | | | | | | | | |
| | TMIN (C) | | | 5.1 | 6.6 | 7.5 | 7.8 | 7.2 | 8.6 | 8.1 | 9.1 | | | | | | | | | | |
| | CANUI( DIM) | | | 0.47 | 0.81 | 0.70 | 0.79 | 0.55 | 0.87 | 0.58 | 0.71 | | | | | | | | | | |
| | RADIATION (CAL) | | | 431 | 572 | 483 | 488 | 454 | 521 | 450 | 466 | | | | | | | | | | |
| | RAINFALL (MM) | | | 19 | 131 | 107 | 186 | 112 | 293 | 150 | 174 | | | | | | | | | | |
| | PE (MM) | | | 26 | 190 | 231 | 267 | 278 | 348 | 339 | 397 | | | | | | | | | | |
| | DEGREE DAYS >5C | 151 | 488 | 367 | 836 | 876 | 913 | 1074 | 1217 | 1284 | 1397 | | | | | | | | | | |
| | DEGREE DAYS >10C | 35 | 52 | 9 | 265 | 312 | 322 | 385 | 501 | 522 | 689 | | | | | | | | | | |
| | DEGREE DAYS >15C | | | | | | | 47 | 65 | 63 | 147 | | | | | | | | | | |
| | CORN HEAT UNITS | 168 | 784 | 551 | 1308 | 1661 | 1926 | 1795 | 2024 | 2067 | 2314 | | | | | | | | | | |
| | NO. OF MAP UNITS | 14 | | 5 | | 2 | | 5 | | 3 | | | | | | | | | | | |

TABLE 9 (cont)

MAXIMUM AND MINIMUM VALUES OF GROWING SEASON CLIMATIC INFORMATION FOR THE MAJOR SOIL GROUPS BY GROWING SEASON LENGTH

| SOIL GROUP | CLIMATIC DATA | GROWING SEASON LENGTH (DAYS) 0 | | 1-74 | | 75-89 | | 90-104 | | 105-119 | | 120-134 | | 135-149 | | 150-164 | | 165-179 | | >180 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| CUMULIC REGOSOL | TMEAN (C) | | | | | 13.8 | 13.8 | | | 15.6 | 15.6 | | | 15.5 | 15.5 | | | | | | |
| | TMAX (C) | | | | | 19.9 | 19.9 | | | 22.4 | 22.4 | | | 21.1 | 21.1 | | | | | | |
| | TMIN (C) | | | | | 7.6 | 7.6 | | | 8.9 | 8.9 | | | 9.9 | 9.9 | | | | | | |
| | CANUI( DIM) | | | | | 0.69 | 0.69 | | | 0.61 | 0.61 | | | 0.90 | 0.90 | | | | | | |
| | RADIATION (CAL) | | | | | 463 | 463 | | | 457 | 457 | | | 438 | 438 | | | | | | |
| | RAINFALL (MM) | | | | | 111 | 111 | | | 184 | 184 | | | 386 | 386 | | | | | | |
| | PE (MM) | | | | | 227 | 227 | | | 402 | 402 | | | 398 | 398 | | | | | | |
| | DEGREE DAYS >5C | | | | | 796 | 796 | | | 1374 | 1374 | | | 1686 | 1686 | | | | | | |
| | DEGREE DAYS >10C | | | | | 282 | 282 | | | 638 | 638 | | | 752 | 752 | | | | | | |
| | DEGREE DAYS >15C | | | | | | | | | 188 | 188 | | | 184 | 184 | | | | | | |
| | CORN HEAT UNITS | | | | | 1323 | 1323 | | | 2271 | 2271 | | | 2662 | 2662 | | | | | | |
| | NO. OF MAP UNITS | | | | | 1 | | | | 1 | | | | 1 | | | | | | | |
| CRYIC ORTHIC REGOSOL | TMEAN (C) | | | 7.8 | 11.9 | | | | | | | | | | | | | | | | |
| | TMAX (C) | | | 10.4 | 17.1 | | | | | | | | | | | | | | | | |
| | TMIN (C) | | | 5.0 | 6.8 | | | | | | | | | | | | | | | | |
| | CANUI( DIM) | | | 0.39 | 0.59 | | | | | | | | | | | | | | | | |
| | RADIATION (CAL) | | | 336 | 422 | | | | | | | | | | | | | | | | |
| | RAINFALL (MM) | | | 3 | 59 | | | | | | | | | | | | | | | | |
| | PE (MM) | | | 8 | 146 | | | | | | | | | | | | | | | | |
| | DEGREE DAYS >5C | 24 | 188 | 109 | 506 | | | | | | | | | | | | | | | | |
| | DEGREE DAYS >10C | | | 102 | 102 | | | | | | | | | | | | | | | | |
| | DEGREE DAYS >15C | | | | | | | | | | | | | | | | | | | | |
| | CORN HEAT UNITS | 6 | 188 | 67 | 709 | | | | | | | | | | | | | | | | |
| | NO. OF MAP UNITS | 78 | | 11 | | | | | | | | | | | | | | | | | |
| DYSTRIC BRUNISOL | TMEAN (C) | | | 11.2 | 14.8 | 15.4 | 15.4 | 14.1 | 16.1 | 16.8 | 16.8 | 13.1 | 15.8 | 13.9 | 16.3 | | | | | 16.2 | 15.8 |
| | TMAX (C) | | | 16.8 | 22.6 | 23.9 | 23.9 | 19.5 | 24.8 | 25.7 | 25.7 | 16.8 | 22.1 | 18.5 | 22.3 | | | | | 19.8 | 20.6 |
| | TMIN (C) | | | 5.1 | 7.4 | 7.8 | 7.8 | 7.2 | 8.6 | 7.8 | 7.9 | 8.5 | 9.7 | 9.3 | 10.4 | | | | | 9.8 | 9.4 |
| | CANUI( DIM) | | | 0.65 | 0.73 | 0.68 | 0.68 | 0.67 | 0.86 | 0.56 | 0.56 | 0.78 | 0.98 | 0.89 | 0.98 | | | | | 0.86 | 0.98 |
| | RADIATION (CAL) | | | 430 | 568 | 529 | 529 | 434 | 527 | 522 | 522 | 416 | 508 | 364 | 429 | | | | | 437 | 482 |
| | RAINFALL (MM) | | | 24 | 99 | 176 | 176 | 113 | 293 | 178 | 178 | 191 | 364 | 484 | 499 | | | | | 271 | 716 |
| | PE (MM) | | | 35 | 196 | 351 | 351 | 267 | 412 | 439 | 439 | 388 | 487 | 313 | 422 | | | | | 483 | 532 |
| | DEGREE DAYS >5C | 637 | 697 | 395 | 1036 | 1389 | 1389 | 1074 | 1486 | 1749 | 1749 | 1056 | 1576 | 1422 | 1781 | | | | | 1813 | 2988 |
| | DEGREE DAYS >10C | 91 | 163 | 36 | 389 | 535 | 535 | 488 | 668 | 842 | 842 | 388 | 722 | 583 | 882 | | | | | 768 | 917 |
| | DEGREE DAYS >15C | | | | | 71 | 71 | 19 | 134 | 225 | 225 | 1 | 171 | 65 | 278 | | | | | 187 | 198 |
| | CORN HEAT UNITS | 1828 | 1133 | 685 | 1716 | 2138 | 2138 | 1783 | 2398 | 2769 | 2769 | 1783 | 2595 | 2388 | 2884 | | | | | 2966 | 3389 |
| | NO. OF MAP UNITS | 2 | | 7 | | 1 | | 3 | | 1 | | 18 | | 2 | | | | | | 3 | |
| ORTHIC REGOSOL | TMEAN (C) | | | 12.1 | 12.1 | 12.6 | 12.6 | 14.1 | 15.9 | 16.1 | 16.9 | 16.4 | 16.4 | 14.3 | 14.3 | | | | | | |
| | TMAX (C) | | | 17.8 | 17.8 | 17.2 | 17.2 | 20.9 | 23.8 | 23.1 | 24.7 | 22.6 | 22.7 | 18.7 | 18.7 | | | | | | |
| | TMIN (C) | | | 6.3 | 6.3 | 8.8 | 8.8 | 7.4 | 8.7 | 9.8 | 9.2 | 10.1 | 18.2 | 9.9 | 9.9 | | | | | | |
| | CANUI( DIM) | | | 0.58 | 0.58 | 0.78 | 0.78 | 0.56 | 0.76 | 0.38 | 0.52 | 0.76 | 0.76 | 0.92 | 0.92 | | | | | | |
| | RADIATION (CAL) | | | 459 | 459 | 488 | 488 | 489 | 587 | 586 | 518 | 485 | 485 | 413 | 413 | | | | | | |
| | RAINFALL (MM) | | | 56 | 56 | 121 | 121 | 186 | 195 | 184 | 198 | 291 | 293 | 423 | 423 | | | | | | |
| | PE (MM) | | | 115 | 115 | 239 | 239 | 343 | 489 | 458 | 599 | 455 | 456 | 328 | 328 | | | | | | |
| | DEGREE DAYS >5C | | | 491 | 491 | 646 | 646 | 1151 | 1377 | 1651 | 1658 | 1583 | 1586 | 1423 | 1423 | | | | | | |
| | DEGREE DAYS >10C | | | 91 | 91 | 197 | 197 | 422 | 628 | 682 | 813 | 774 | 776 | 585 | 585 | | | | | | |
| | DEGREE DAYS >15C | | | | | | | 189 | 135 | 188 | 255 | 234 | 236 | 188 | 188 | | | | | | |
| | CORN HEAT UNITS | | | 781 | 781 | 1838 | 1838 | 1918 | 2269 | 2391 | 2668 | 2579 | 2584 | 2382 | 2382 | | | | | | |
| | NO. OF MAP UNITS | | | 1 | | 1 | | 3 | | 7 | | 8 | | 1 | | | | | | | |

TABLE 9 (cont)

MAXIMUM AND MINIMUM VALUES OF GROWING SEASON CLIMATIC INFORMATION FOR THE MAJOR SOIL GROUPS BY GROWING SEASON LENGTH

| SOIL GROUP | CLIMATIC DATA | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX |
| HUMIC GLEYSOL | TMEAN (C) | | | | 14.7 14.9 | 15.0 16.4 | 15.8 16.8 | 16.4 16.5 | 16.8 16.8 | 16.2 17.3 | |
| | TMAX (C) | | | | 21.8 21.9 | 21.4 23.7 | 21.8 23.2 | 22.1 23.5 | 22.8 22.7 | 19.2 22.9 | |
| | TMIN (C) | | | | 7.7 7.9 | 8.3 9.3 | 9.9 10.4 | 9.2 10.4 | 10.9 11.0 | 9.2 11.8 | |
| | CAMUI( DIM) | | | | 0.81 0.83 | 0.54 0.80 | 0.72 0.92 | 0.87 0.93 | 0.90 0.93 | 0.88 0.89 | |
| | RADIATION (CAL) | | | | 469 484 | 445 512 | 439 484 | 448 467 | 423 458 | 426 434 | |
| | RAINFALL (MM) | | | | 211 238 | 128 230 | 289 405 | 171 382 | 358 446 | 404 496 | |
| | PE (MM) | | | | 337 353 | 356 458 | 384 511 | 431 547 | 457 481 | 461 530 | |
| | DEGREE DAYS >5C | | | | 1244 1263 | 1202 1488 | 1575 1677 | 1771 1835 | 1863 1996 | 1770 2214 | |
| | DEGREE DAYS >10C | | | | 491 511 | 548 709 | 764 860 | 905 947 | 969 1062 | 750 1234 | |
| | DEGREE DAYS >15C | | | | 38 56 | 70 189 | 198 290 | 267 367 | 324 377 | 184 498 | |
| | CORN HEAT UNITS | | | | 2077 2109 | 1992 2442 | 2623 2757 | 2938 3032 | 3085 3283 | 2988 3631 | |
| | NO. OF MAP UNITS | | | | 3 | 6 | 3 | 6 | 3 | 2 | |
| ORTHIC GLEYSOL | TMEAN (C) | | | | 14.5 15.9 | 16.3 15.5 | 15.7 16.0 | 16.4 16.4 | | | |
| | TMAX (C) | | | | 19.8 24.2 | 19.7 22.0 | 22.1 22.2 | 21.9 21.9 | | | |
| | TMIN (C) | | | | 7.6 9.2 | 8.5 9.2 | 9.3 9.9 | 10.9 10.9 | | | |
| | CAMUI( DIM) | | | | 0.55 0.85 | 0.59 0.91 | 0.90 0.92 | 0.93 0.93 | | | |
| | RADIATION (CAL) | | | | 418 518 | 404 460 | 399 450 | 431 431 | | | |
| | RAINFALL (MM) | | | | 127 272 | 152 365 | 330 378 | 423 423 | | | |
| | PE (MM) | | | | 299 396 | 276 397 | 384 412 | 446 446 | | | |
| | DEGREE DAYS >5C | | | | 1074 1470 | 1128 1383 | 1454 1625 | 1814 1814 | | | |
| | DEGREE DAYS >10C | | | | 442 651 | 459 641 | 692 787 | 942 942 | | | |
| | DEGREE DAYS >15C | | | | 39 116 | 45 140 | 173 215 | 308 308 | | | |
| | CORN HEAT UNITS | | | | 1794 2398 | 1864 2283 | 2596 2699 | 3013 3013 | | | |
| | NO. OF MAP UNITS | | | | 6 | 10 | 3 | 1 | | | |
| CRYIC ORTHIC GLEYSOL | TMEAN (C) | | 10.0 11.4 | | | | | | | | |
| | TMAX (C) | | 14.1 16.2 | | | | | | | | |
| | TMIN (C) | | 5.8 6.7 | | | | | | | | |
| | CAMUI( DIM) | | 0.87 0.81 | | | | | | | | |
| | RADIATION (CAL) | | 397 429 | | | | | | | | |
| | RAINFALL (MM) | | 33 57 | | | | | | | | |
| | PE (MM) | | 69 132 | | | | | | | | |
| | DEGREE DAYS >5C | 231 231 | 324 435 | | | | | | | | |
| | DEGREE DAYS >10C | | 8 69 | | | | | | | | |
| | DEGREE DAYS >15C | | | | | | | | | | |
| | CORN HEAT UNITS | 301 301 | 427 656 | | | | | | | | |
| | NO. OF MAP UNITS | 1 | 6 | | | | | | | | |
| FIBRISOL | TMEAN (C) | | 10.3 13.9 | | 14.0 15.6 | 14.5 16.3 | 16.3 16.3 | | | | |
| | TMAX (C) | | 14.7 21.4 | | 19.5 22.9 | 20.5 22.8 | 22.4 22.4 | | | | |
| | TMIN (C) | | 6.0 6.5 | | 7.6 9.4 | 8.3 10.1 | 10.2 10.2 | | | | |
| | CAMUI( DIM) | | 0.80 0.83 | | 0.72 0.88 | 0.56 0.91 | 0.87 0.87 | | | | |
| | RADIATION (CAL) | | 417 494 | | 429 485 | 406 485 | 484 484 | | | | |
| | RAINFALL (MM) | | 160 173 | | 193 353 | 160 379 | 291 291 | | | | |
| | PE (MM) | | 92 199 | | 269 354 | 270 429 | 455 455 | | | | |
| | DEGREE DAYS >5C | | 415 970 | | 1055 1361 | 1182 1519 | 1560 1560 | | | | |
| | DEGREE DAYS >10C | | 6 293 | | 484 596 | 485 748 | 772 772 | | | | |
| | DEGREE DAYS >15C | | | | 29 111 | 44 213 | 234 234 | | | | |
| | CORN HEAT UNITS | | 567 1613 | | 1758 2295 | 1973 2587 | 2575 2575 | | | | |
| | NO. OF MAP UNITS | | 2 | | 16 | 15 | 1 | | | | |

TABLE 9 (cont)

MAXIMUM AND MINIMUM VALUES OF GROWING SEASON CLIMATIC INFORMATION FOR THE MAJOR SOIL GROUPS BY GROWING SEASON LENGTH

| SOIL GROUP | CLIMATIC DATA | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX | MIN--MAX |
| CRYIC FIBRISOL | TMEAN (C) | | 10.0 13.1 | 14.1 16.2 | 16.1 16.6 | 16.3 15.0 | | | | | |
| | TMAX (C) | | 15.8 18.9 | 20.7 20.8 | 19.3 21.2 | 20.1 21.5 | | | | | |
| | TMIN (C) | | 5.8 7.3 | 7.6 7.7 | 8.8 8.9 | 8.2 9.1 | | | | | |
| | CAMUI( DIM) | | 0.70 0.80 | 0.72 0.88 | 0.68 0.83 | 0.75 0.89 | | | | | |
| | RADIATION (CAL) | | 406 453 | 454 477 | 421 469 | 405 452 | | | | | |
| | RAINFALL (MM) | | 96 151 | 123 143 | 106 213 | 105 301 | | | | | |
| | PE (MM) | | 78 209 | 253 263 | 283 295 | 309 383 | | | | | |
| | DEGREE DAYS >5C | | 371 712 | 988 995 | 953 1096 | 1155 1327 | | | | | |
| | DEGREE DAYS >10C | | 19 219 | 361 362 | 381 433 | 456 581 | | | | | |
| | DEGREE DAYS >15C | | | | 20 32 | 38 99 | | | | | |
| | CORN HEAT UNITS | | 535 1174 | 1654 1668 | 1568 1831 | 1938 2208 | | | | | |
| | NO. OF MAP UNITS | | 6 | 2 | 3 | 5 | | | | | |
| ROCKLAND | TMEAN (C) | | 9.0 13.6 | 11.6 14.9 | 11.0 14.8 | 14.7 15.9 | | 15.9 15.9 | | | |
| | TMAX (C) | | 13.1 21.1 | 15.5 23.1 | 16.2 21.2 | 20.8 21.9 | | 22.1 22.1 | | | |
| | TMIN (C) | | 5.0 7.4 | 6.1 8.3 | 7.3 8.6 | 8.6 9.9 | | 9.8 9.8 | | | |
| | CAMUI( DIM) | | 0.65 0.86 | 0.52 0.82 | 0.49 0.83 | 0.81 0.84 | | 0.81 0.81 | | | |
| | RADIATION (CAL) | | 313 498 | 386 511 | 378 464 | 437 470 | | 468 468 | | | |
| | RAINFALL (MM) | | 14 209 | 87 241 | 115 315 | 283 304 | | 363 363 | | | |
| | PE (MM) | | 14 186 | 149 268 | 211 346 | 300 395 | | 433 433 | | | |
| | DEGREE DAYS >5C | 20 605 | 251 927 | 559 1218 | 709 1137 | 1188 1422 | | 1639 1639 | | | |
| | DEGREE DAYS >10C | 61 61 | 14 279 | 76 455 | 158 486 | 497 680 | | 801 801 | | | |
| | DEGREE DAYS >15C | | | 15 15 | 55 78 | 62 180 | | 220 220 | | | |
| | CORN HEAT UNITS | 13 943 | 286 1531 | 827 2012 | 1694 1894 | 1970 2357 | | 2717 2717 | | | |
| | NO. OF MAP UNITS | 27 | 26 | 7 | 7 | 3 | | 1 | | | |

## 3.3 THE CALCULATION OF PRODUCTION POTENTIALS

Production potentials for any region can be calculated if estimates of per unit yields and hectares suitable for the production of that crop are available. This section presents information on these two major subject areas.

Very large volumes of data were generated in this assessment of yield potentials and all results could not be presented. Thus only highlights are outlined in this section and all other data have been stored on the data base management system which has been an integral part of this project from the beginning.*

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*The Canada Soil Information System (CanSIS) was used as the data base management system for this project. All data stored on the system are available from the authors on request.

### 3.3.1 Estimates of Crop Yield

Predicted yield levels for constraint-free and anticipated yields for each crop and each soil map unit are shown on the microfiche accompanying this report. Data on the first microfiche are arranged in two parts, and listed such that individual soil map units are shown alphabetically and incrementally. The first part summarizes basic climatic information for each map unit with a growing season of sufficient length to mature at least one of the crops under study. The data in the second part show the proportion of land suitable for each crop in each map unit, some general growing season information and net biomass and constraint-free yields. This microfiche can be used to determine crop suitability and constraint-free yield potential (tonnes/ha) for individual soil map units. Anticipated yield values for each map unit are shown on the second microfiche.

The second microfiche lists those soil map units (alphabetically and incrementally) that are suitable for the production of each of the five crops considered in this study. Constraint-free and anticipated dry matter and fresh weight yield estimates (tonnes/ha) are provided for each reported map unit, as well as a ratio comparing the anticipated yield with the best potential (constraint-free) yield for that crop in the country. Also, values for the three crop production constraints (moisture, workability and soil) are given, as well as some basic agrometeorological variables. This microfiche can be used in examining the production and geographic potential of the individual crops considered in this study.

In using either of the two microfiche it must be remembered that the yield levels reported are those for the best soils in the map unit. In instances where a portion of the map unit is well suited, a portion suited and the remainder not suited, only the yield for the well suited area is reported. For areas lacking well suited soils, the yields have been reduced (by 25 per cent) to the suited level. Information showing the proportion of the map unit variously suited for the production of the crop has been stored in the data base, and is available from the authors on request.

### 3.3.2 Verification of the Yield Estimates

Anticipated yield for a given soil map unit can be considered as the potential long term yield for that area, obtainable under optimal soil and crop management conditions. Since these values are predictions, reflecting the particular crop growth coefficients used, they must be validated against available data.

Theoretically anticipated yields should be compared with long term experimental yields, since the latter supposedly represent yields obtained under optimal management. This, however, is not easily achieved in a study of this type for several reasons. First, although many experimental yields for many crops are available, very few long term experiments have been reported in Canada and the locations of these have been poorly documented. Short term experiments are of minimal

application because of the overriding influence of weather on yield, complicated further by the cultivar utilized. Secondly, experimental data vary with the nature of the factor (treatment level) they were designed to measure, and as a consequence a series of values are available, some even beyond optimal conditions of management. Thirdly, and perhaps of greatest significance, experimental data reflect yields from small, carefully documented sites. Such values must be used with caution when compared with yield estimates from large scale studies (such as this study) where individual sites are representative of several thousands of hectares.

The above not withstanding, Table 10 illustrates the performance of the crop growth models for several crops. The reported data were chosen after an extensive search of the literature, applying the selection criteria described above. In the case of Bates (1973) and Stevenson and Baldwin (1978), the map units chosen represent as closely as possible the reported location of the experiment. For Halstead's (1978) data, where yields of individual soils were reported, map units representing relatively pure agglomerations of these soils were chosen. The results indicate that for corn and wheat the crop growth models have an accuracy of slightly higher than 80 per cent of reported values. In general this compares quite favorably with reported standard deviations of long term yields (Halstead, 1978). Simple correlation coefficients of the data are approximately 0.9 for corn and 0.8 for wheat. No comment can be made for soybean, potato and phaseolus bean because of insufficient data.

## 3.4 THE LAND SUITABILITY ASSESSMENT

The results of the land suitability assessment for each crop are presented in the maps and tables in this section (Figs. 1-5 and Tables 11-20). Three items of data are shown for each of the five crops considered in the assessment. The first is a generalized map in six degrees of land suitability. This shows the area with the highest potential for the crop under consideration, as well as the comparative potential of all other areas where the crop can be grown*. The second is a table showing the amount of land (hectares) in various degrees of suitability for the production of the crop, by major climatic divisions and growing season length, for each climatic division where the crop can be grown. The third reports similar data but classified according to soil groups rather than climatic divisions.

In using these data several considerations must be kept in mind. First, the calculations assume a high level of soil and crop management; no allowances are made for yield variation due to varying levels of management inputs. Secondly, the land suitability

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* The assignment of a suitability class to a specific area does not imply that the entire area can be used for that crop. Rather, it means that the better soils in that area have yield potentials of a given level compared to the best areas for that crop in the country.

TABLE 10. COMPARISON BETWEEN LONG TERM CROP YIELDS AND ANTICIPATED YIELDS PREDICTED BY THE CROP GROWTH MODEL.

| Soil Type | Location | Years of Observation | Crop | Mean Yield (Kg/ha) | Comparable Map Unit | Predicted Yield (Kg/ha) |
|---|---|---|---|---|---|---|
| Fox SL | Brant Co. | 1968-73 | corn | 5330 | C 1/2 | 5184 |
| Conestoga L | Wellington Co. | 1968-73 | corn | 7120 | C 1/14 | 6101 |
| Oneida CL | Halton Co. | 1968-73 | corn | 6805 | C 1/12 | 6025 |
| Brookston C | Ridgetown | 1969-78 | corn | 7175 | G 1/7 | 6788 |
| Brookston C | Ridgetown | 1969-78 | soybean | 2375 | G 1/7 | 3486 |
| - | Dufferin | 1964-67 | potato | 29442 | D 3/2 | 18929 |
| - | Simcoe | 1964-67 | potato | 20888 | D 3/2 | 18929 |
| Sceptre C | - | 1966-76 | wheat | 1748±404 | A 1/15 | 1900 |
| Haverhill L | - | 1966-76 | wheat | 1546±404 | A 1/9 | 1420 |
| | | | | | A 1/25 | 1542 |
| Regina C | - | 1966-76 | wheat | 2085±404 | A 2/55 | 2718 |
| Weyburn L | - | 1966-76 | wheat | 1883±336 | A 2/43 | 1888 |
| | | | | | A 2/42 | 2363 |
| Melfort Sic | - | 1966-76 | wheat | 2623±336 | A 3/98 | 2912 |
| Oxbow L | - | 1966-76 | wheat | 2085±202 | A 3/95 | 2266 |
| | | | | | A 3/76 | 1864 |
| Whitewood L | - | 1966-76 | wheat | 2286±269 | A 3/94 | 1890 |
| Waitville L | - | 1966-76 | wheat | 2085±336 | C 2/21 | 2496 |
| | | | | | C 2/38 | 1776 |

Corn, soybean and potato yields are taken from Bates (1973) and Stevenson and Baldwin (1978). Wheat yields are taken from Halstead (1978).

data for an individual crop are not additive to that from another crop; no allowances have been made for one crop substituting for another, or for land needs for crop rotations or fallow. Also, land requirements for nonagricultural uses such as transportation, recreation, urban development or forestry have not been considered. Finally the general nature of the study and the assumptions used, as well as the scale of application (1:5,000,000) introduce a series of errors of estimate which must be considered when interpreting the results.

In general terms, commercial agriculture is viable in all areas classed as marginally suitable or better. The unsuited class, with yield levels of less than 20 per cent of maximum potential, correlates quite well with traditional cropping patterns, where practical experience indicates these areas to be unsuitable. Occasionally, satisfactory yields can be obtained from such areas but the risk of failure is very high and commercial agriculture is not recommended.

The prime areas for all crops studied in this assessment is southwestern Ontario, followed closely by eastern Ontario, southwestern Quebec and the Fraser River delta of British Columbia. The Winnipeg plain in southern Manitoba has yield potentials just marginally lower than those of the above mentioned areas for all crops except soybean, where no potential is shown (short season cultivars have some potential in this area but yields comparable to those from better climatic areas cannot be expected).

The Atlantic region has moderate potentials for spring wheat, potato and phaseolus bean, but generally the landscapes are such that only small portions of this area can be cultivated. The Great Plains region has minimum potential for all crops other than spring wheat, but extensive areas are suitable for cultivation. The notable exception is southern Manitoba and a portion of eastern Saskatchewan which have moderate potentials for all crops other than soybean.

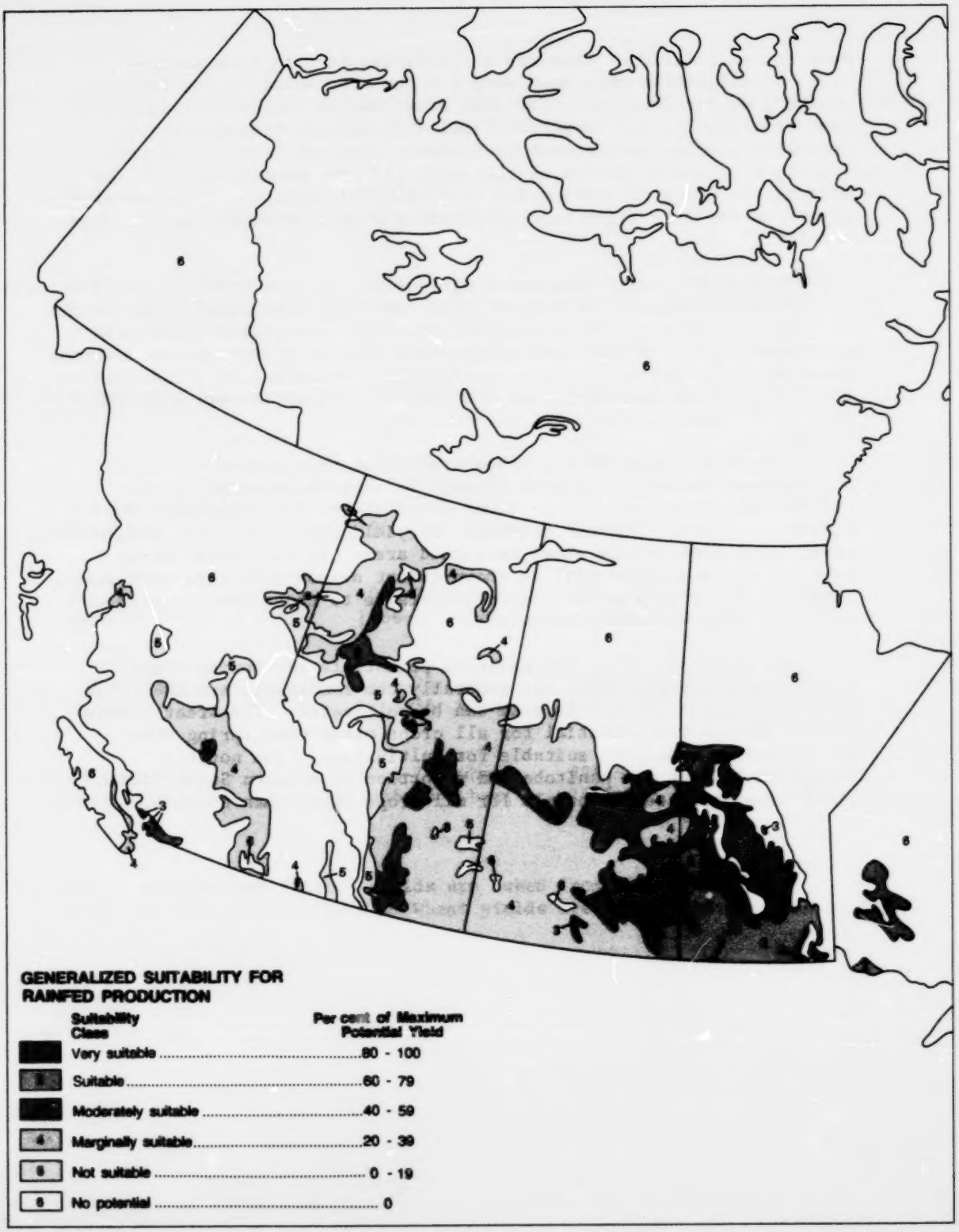
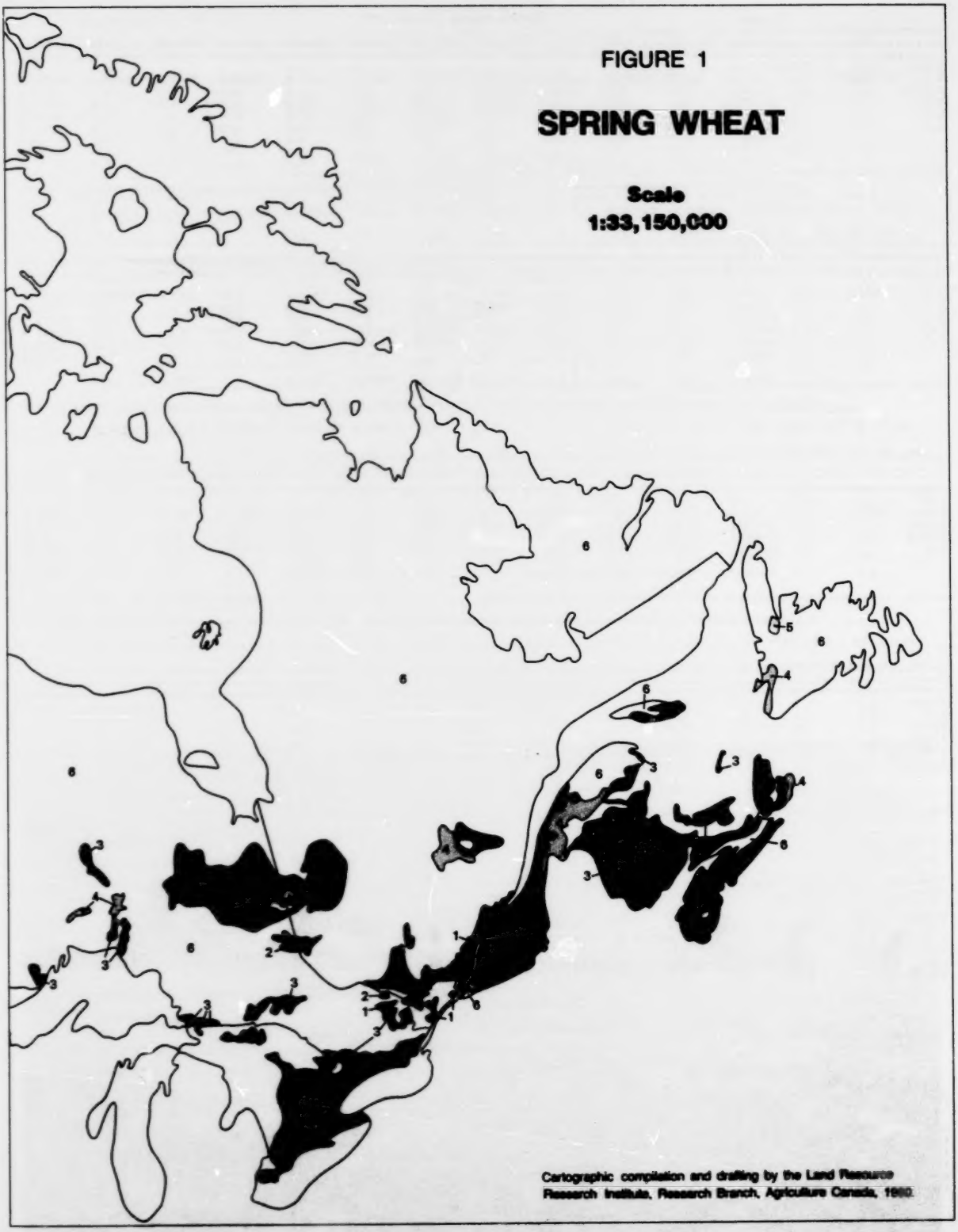

GENERALIZED SUITABILITY FOR RAINFED PRODUCTION
Suitability Class
Per cent of Maximum Potential Yield
Very suitable ..... 80 - 100
Suitable ..... 60 - 79
Moderately suitable ..... 40 - 59
Marginally suitable ..... 20 - 39
Not suitable ..... 0 - 19
No potential ..... 0

FIGURE 1

# SPRING WHEAT

**Scale**
**1:33,150,000**



Cartographic compilation and drafting by the Land Resource Research Institute, Research Branch, Agriculture Canada, 1980

TABLE II

EXTENT OF LAND(THOUSANDS OF HECTARES) BY MAJOR CLIMATIC ZONES BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** WHEAT **

| MAJOR CLIMATIC ZONE | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH(DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CRYOBOREAL | 0 | 810.8 | 69884.7 | 95648.3 | 141297.1 | 98536.3 | 3604.6 | 1887.2 | 3983.7 | 1987.2 | 1680.2 | 376239.6 |
| | 1-19% | 0.0 | 0.0 | 1580.2 | 305.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1885.2 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 13819.0 | 1406.3 | 19.7 | 26.2 | 0.0 | 0.0 | 0.0 | 15271.1 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 1873.0 | 4201.4 | 247.4 | 49.7 | 0.0 | 0.0 | 0.0 | 6371.5 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 713.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 713.6 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 1580.2 | 15996.9 | 6321.2 | 267.1 | 75.9 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.3-1.0 | 1.0-3.0 | 1.3-3.7 | 1.0-2.9 | 1.6-2.7 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 9 | 88 | 23 | 7 | 3 | 0 | 0 | 0 | |
| BOREAL | 0 | 0.0 | 0.0 | 0.0 | 3088.7 | 43917.4 | 10665.9 | 4369.5 | 0.0 | 1617.8 | 991.1 | 65360.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 200.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 200.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 2731.2 | 12243.6 | 0.0 | 0.0 | 0.0 | 0.0 | 33.9 | 15008.7 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 353.0 | 7988.8 | 4150.7 | 537.7 | 0.0 | 238.1 | 0.0 | 13188.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 2194.2 | 1081.8 | 259.2 | 0.0 | 0.0 | 0.0 | 3535.2 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 96.4 | 49.6 | 0.0 | 0.0 | 0.0 | 146.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 3284.2 | 22330.6 | 5288.9 | 846.5 | 0.0 | 238.1 | 33.9 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-2.5 | 1.1-4.3 | 2.5-4.5 | 2.5-4.4 | 0.0-0.0 | 2.5-2.5 | 1.5-1.5 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 26 | 85 | 33 | 17 | 0 | 1 | 1 | |
| MESIC | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2207.6 | 1051.8 | 442.5 | 0.0 | 3701.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 39.3 | 17.9 | 0.0 | 0.0 | 77.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 675.5 | 738.2 | 125.4 | 0.0 | 1539.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2098.7 | 2797.7 | 501.6 | 0.0 | 5398.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 251.2 | 0.0 | 0.0 | 0.0 | 251.2 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3088.7 | 3953.9 | 627.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-4.4 | 2.0-4.3 | 3.0-4.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 21 | 1 | 0 | |

TABLE 12

EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** WHEAT **

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BROWN CHERNOZEMIC | 0 | 0.0 | 0.0 | 0.0 | 1576.2 | 2870.0 | 0.0 | 0.0 | 0.0 | 442.5 | 0.0 | 4888.7 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 108.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 108.5 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 1109.2 | 4473.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5582.8 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 75.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 75.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1284.9 | 4473.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-2.2 | 1.1-1.7 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 6 | 17 | 0 | 0 | 0 | 0 | 0 | |
| DARK BROWN CHERNOZEMIC | 0 | 0.0 | 0.0 | 0.0 | 1330.8 | 1588.1 | 0.0 | 395.1 | 0.0 | 0.0 | 0.0 | 3323.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 1927.5 | 4961.8 | 0.0 | 43.9 | 0.0 | 0.0 | 0.0 | 6933.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 28.3 | 1112.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1140.8 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 14.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1955.8 | 6091.0 | 0.0 | 43.9 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.1-2.6 | 1.6-3.3 | 0.0-0.0 | 1.6-1.6 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 16 | 16 | 0 | 1 | 0 | 0 | 0 | |
| BLACK CHERNOZEMIC | 0 | 0.0 | 0.0 | 532.1 | 877.0 | 3602.6 | 361.6 | 0.0 | 71.7 | 0.0 | 0.0 | 5534.7 |
| | 1-19% | 0.0 | 0.0 | 59.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 59.1 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 5015.9 | 1235.2 | 0.0 | 0.0 | 17.9 | 0.0 | 0.0 | 6269.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 534.3 | 4958.4 | 718.2 | 0.0 | 0.0 | 0.0 | 0.0 | 6208.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 1995.2 | 539.4 | 0.0 | 0.0 | 0.0 | 0.0 | 2534.6 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 59.1 | 5550.2 | 8180.8 | 1257.7 | 0.0 | 17.9 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.9-0.9 | 1.2-2.6 | 1.6-3.7 | 2.6-3.9 | 0.0-0.0 | 2.6-2.8 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 1 | 16 | 22 | 4 | 0 | 1 | 0 | 0 | |
| DARK GRAY CHERNOZEMIC | 0 | 0.0 | 0.0 | 0.0 | 825.3 | 1282.3 | 855.4 | 0.0 | 0.0 | 0.0 | 0.0 | 2963.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 845.7 | 273.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1118.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 171.5 | 678.7 | 629.4 | 0.0 | 0.0 | 0.0 | 0.0 | 1479.5 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 56.0 | 132.4 | 0.0 | 0.0 | 0.0 | 0.0 | 188.3 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1017.1 | 1007.9 | 761.8 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.2-2.4 | 1.3-3.4 | 2.6-4.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 8 | 5 | 5 | 0 | 0 | 0 | 0 | |
| BROWN SOLONETZ | 0 | 0.0 | 0.0 | 0.0 | 484.5 | 821.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1306.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 530.6 | 1277.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1808.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 530.6 | 1277.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.2-1.6 | 1.2-1.9 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | |
| BLACK SOLONETZ | | 0.0 | 0.0 | 54.3 | 250.8 | 442.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 798.6 |
| | | 0.0 | 0.0 | 54.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 54.3 |
| | | 0.0 | 0.0 | 0.0 | 319.8 | 295.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 614.9 |
| | | 0.0 | 0.0 | 0.0 | 585.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 585.5 |
| | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 54.3 | 904.9 | 295.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-3.0 | 1.0-1.6 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | |

TABLE 12 (cont)

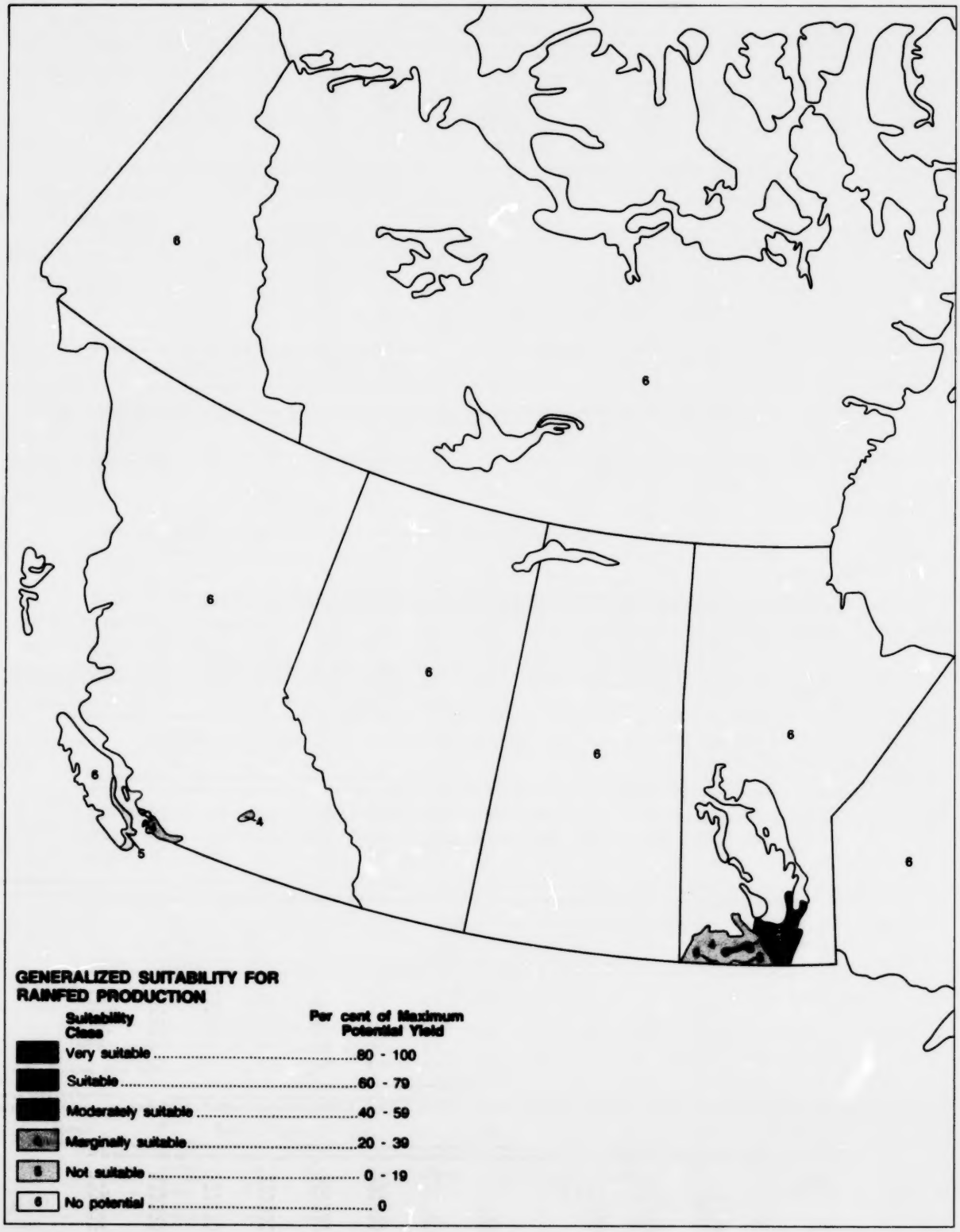
EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** WHEAT **

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLACK SOLOD | 0 | 0.0 | 0.0 | 0.0 | 383.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 383.6 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 1692.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1692.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 471.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 471.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 2123.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-2.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | |
| GRAY BROWN LUVISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 397.3 | 316.7 | 0.0 | 0.0 | 713.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 174.1 | 279.5 | 0.0 | 0.0 | 453.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1591.9 | 2249.1 | 0.0 | 0.0 | 3840.9 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.2 | 0.0 | 0.0 | 0.0 | 20.2 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1784.2 | 2528.5 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.0-4.4 | 2.5-4.3 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 10 | 0 | 0 | |
| GRAY LUVISOL | 0 | 4982.8 | 9212.9 | 12294.9 | 27198.7 | 12285.9 | 1533.1 | 158.1 | 0.0 | 0.0 | 0.0 | 67888.3 |
| | 1-19% | 0.0 | 0.0 | 1443.5 | 305.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1748.5 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 4162.7 | 613.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4776.3 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 154.0 | 2182.3 | 1180.0 | 34.6 | 0.0 | 0.0 | 0.0 | 3550.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 241.5 | 67.4 | 29.8 | 0.0 | 0.0 | 0.0 | 338.9 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 29.4 | 0.0 | 0.0 | 0.0 | 29.4 |
| | TOTAL | 0.0 | 0.0 | 1443.5 | 4621.7 | 3037.5 | 1247.4 | 93.8 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.5-1.0 | 1.0-2.6 | 1.5-4.3 | 2.5-3.5 | 2.5-4.4 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 6 | 31 | 21 | 6 | 4 | 0 | 0 | 0 | |
| HUMO-FERRIC PODZOL | 0 | 584.5 | 25517.1 | 22468.6 | 68258.1 | 62692.6 | 6501.8 | 4755.9 | 3556.6 | 3583.1 | 1556.8 | 199392.8 |
| | 1-19% | 0.0 | 0.0 | 23.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.6 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 194.2 | 133.0 | 19.7 | 0.0 | 0.0 | 0.0 | 0.0 | 346.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 103.9 | 1421.0 | 1300.6 | 670.3 | 11.3 | 0.0 | 0.0 | 3575.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 600.9 | 149.2 | 317.6 | 26.3 | 0.0 | 0.0 | 1113.8 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 23.6 | 298.2 | 2154.9 | 1569.5 | 988.7 | 37.6 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.3-0.3 | 1.3-2.7 | 2.0-3.7 | 1.8-4.2 | 2.6-4.0 | 3.0-3.9 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 1 | 5 | 6 | 12 | 16 | 1 | 0 | 0 | |
| MELANIC BRUNISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1264.1 | 668.3 | 0.0 | 0.0 | 1932.4 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 299.2 | 338.6 | 0.0 | 0.0 | 637.8 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 247.6 | 384.1 | 0.0 | 0.0 | 631.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 546.8 | 722.7 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-4.2 | 2.8-4.3 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 6 | 0 | 0 | |
| EUTRIC BRUNISOL | 0 | 24916.0 | 25021.6 | 1580.7 | 4791.1 | 916.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57185.3 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 131.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 131.5 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 21.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 21.6 | 131.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-2.0 | 1.5-1.5 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | |

TABLE 12 (cont)

EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** WHEAT **

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DYSTRIC BRUNISOL | 0 | 810.9 | 26787.5 | 898.5 | 1615.1 | 239.1 | 3357.2 | 305.7 | 0.0 | 0.0 | 436.0 | 34850.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 99.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 99.6 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 32.7 | 0.0 | 0.0 | 26.2 | 0.0 | 0.0 | 33.0 | 92.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 65.5 | 0.0 | 242.6 | 70.8 | 0.0 | 0.0 | 0.0 | 378.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.2 | 0.0 | 0.0 | 0.0 | 20.2 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 197.8 | 0.0 | 242.6 | 117.2 | 0.0 | 0.0 | 33.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-2.4 | 0.0-0.0 | 2.3-3.1 | 1.0-4.2 | 0.0-0.0 | 0.0-0.0 | 1.5-1.5 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 2 | 0 | 5 | 2 | 0 | 0 | 1 | |
| ORTHIC REGOSOL | 0 | 0.0 | 6833.6 | 2350.7 | 1132.7 | 720.2 | 246.3 | 17.3 | 0.0 | 0.0 | 0.0 | 10598.7 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 379.6 | 95.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 474.7 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 35.5 | 0.0 | 0.0 | 0.0 | 0.0 | 35.5 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 379.6 | 95.3 | 42.2 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.5-2.1 | 1.3-1.6 | 2.0-3.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | |
| CUMULIC REGOSOL | 0 | 0.0 | 0.0 | 3047.9 | 0.0 | 587.8 | 0.0 | 24.7 | 0.0 | 0.0 | 0.0 | 3660.4 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 0.0 | 0.0 | 4.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.5-2.5 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| HUMIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 70.1 | 1360.0 | 198.2 | 86.6 | 12.9 | 102.8 | 0.0 | 1715.6 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 191.1 | 132.1 | 0.0 | 15.0 | 0.0 | 0.0 | 0.0 | 338.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 15.1 | 0.0 | 51.3 | 0.0 | 100.8 | 363.9 | 0.0 | 530.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 123.2 | 131.4 | 150.8 | 581.7 | 0.0 | 910.9 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.4 | 238.8 | 0.0 | 0.0 | 0.0 | 294.4 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 206.1 | 132.1 | 230.9 | 484.8 | 267.6 | 865.2 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.5-2.3 | 1.7-1.9 | 2.6-2.5 | 2.0-2.0 | 3.2-3.3 | 2.5-2.5 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 3 | 2 | 3 | 4 | 3 | 2 | 0 | |
| ORTHIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 6833.0 | 5179.0 | 1269.7 | 0.0 | 0.0 | 0.0 | 0.0 | 13281.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 1047.0 | 181.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1228.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.2 | 0.0 | 0.0 | 0.0 | 13.2 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1047.0 | 181.2 | 13.2 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.3-2.8 | 3.1-3.2 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 0 | |
| FIBRISOL | 0 | 0.0 | 1137.2 | 0.0 | 14123.2 | 22098.1 | 43.5 | 0.0 | 0.0 | 0.0 | 0.0 | 37402.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 291.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 291.4 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 712.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 712.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 43.5 | 0.0 | 0.0 | 0.0 | 0.0 | 43.5 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 291.4 | 712.2 | 43.5 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.8-1.7 | 2.3-2.6 | 3.3-3.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 6 | 2 | 1 | 0 | 0 | 0 | 0 | |
| CRYIC FIBRISOL | 0 | 0.0 | 19103.0 | 681.7 | 18281.0 | 23760.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 93680.2 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-1.6 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |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GENERALIZED SUITABILITY FOR RAINFED PRODUCTION
Suitability Class
Per cent of Maximum Potential Yield
Very suitable ..... 80 - 100
Suitable ..... 60 - 79
Moderately suitable ..... 40 - 59
Marginally suitable ..... 20 - 39
Not suitable ..... 0 - 19
No potential ..... 0

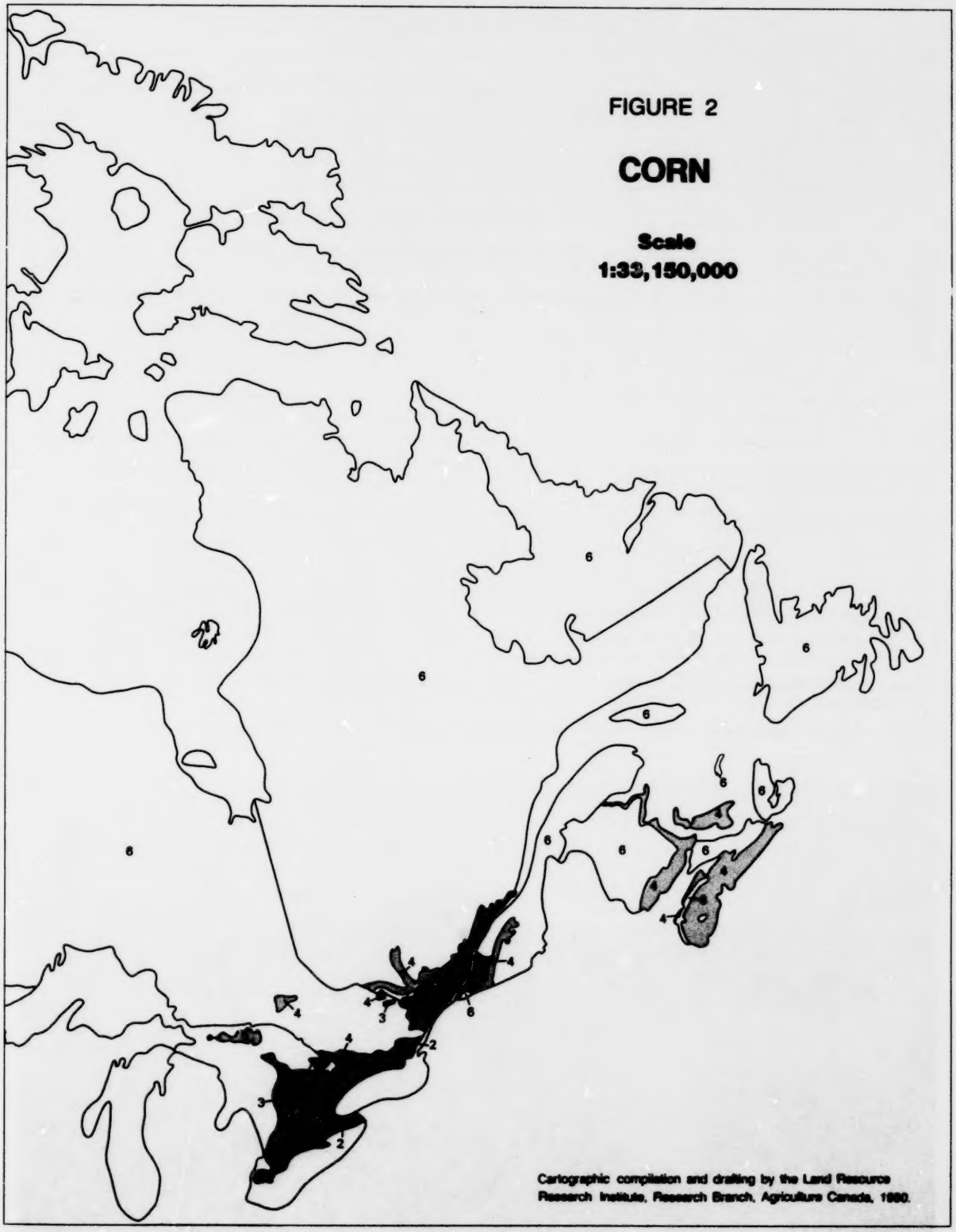


FIGURE 2
CORN
Scale
1:33,150,000
Cartographic compilation and drafting by the Land Resource Research Institute, Research Branch, Agriculture Canada, 1990.

TABLE 13

EXTENT OF LAND(THOUSANDS OF HECTARES) BY MAJOR CLIMATIC ZONES BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** CORN **

| MAJOR CLIMATIC ZONE | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH(DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CRYOBOREAL | 0 | 810.8 | 69004.7 | 57028.5 | 157293.7 | 104857.6 | 3871.5 | 1083.0 | 3564.7 | 1987.2 | 1000.2 | 400480.2 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| BOREAL | 0 | 0.0 | 0.0 | 0.0 | 7092.8 | 65546.5 | 13723.7 | 4831.9 | 0.0 | 1515.4 | 957.2 | 93267.2 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 67.7 | 67.7 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 709.6 | 996.6 | 722.8 | 0.0 | 340.1 | 0.0 | 2769.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1234.5 | 52.2 | 0.0 | 0.0 | 0.0 | 1286.7 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 709.6 | 2231.1 | 775.1 | 0.0 | 340.1 | 67.7 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.0-3.2 | 1.9-4.8 | 1.7-4.9 | 0.0-0.0 | 2.0-2.7 | 1.2-1.2 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 2 | 12 | 13 | 0 | 1 | 1 | |
| MESIC | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2611.2 | 1370.2 | 442.5 | 0.0 | 4423.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 121.0 | 62.4 | 0.0 | 0.0 | 183.4 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2543.6 | 2002.3 | 125.4 | 0.0 | 4671.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 98.6 | 1170.8 | 501.6 | 0.0 | 1769.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2761.2 | 3235.5 | 627.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.5-4.9 | 2.1-5.5 | 4.3-5.8 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 21 | 1 | 0 | |

TABLE 14

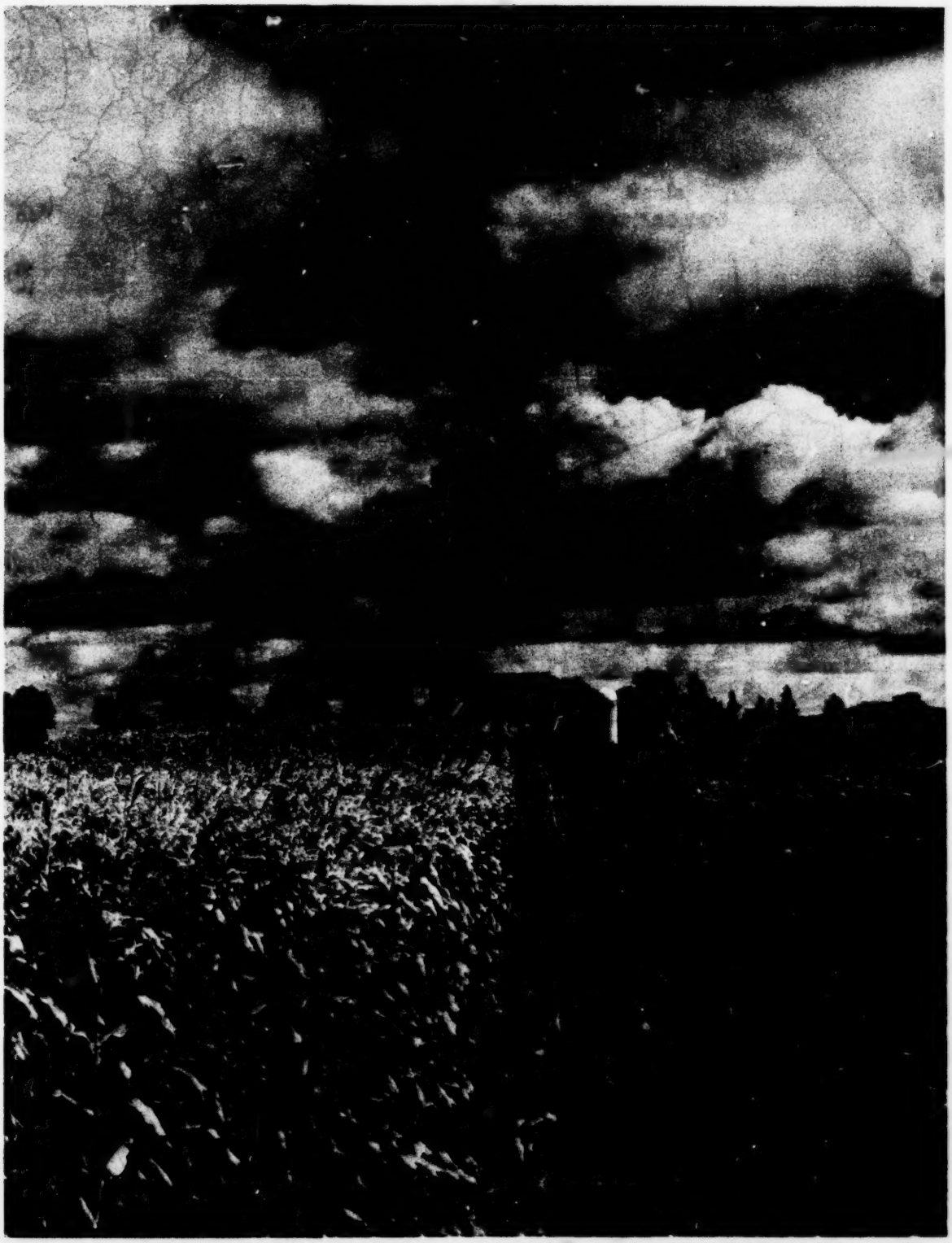
EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** CORN **

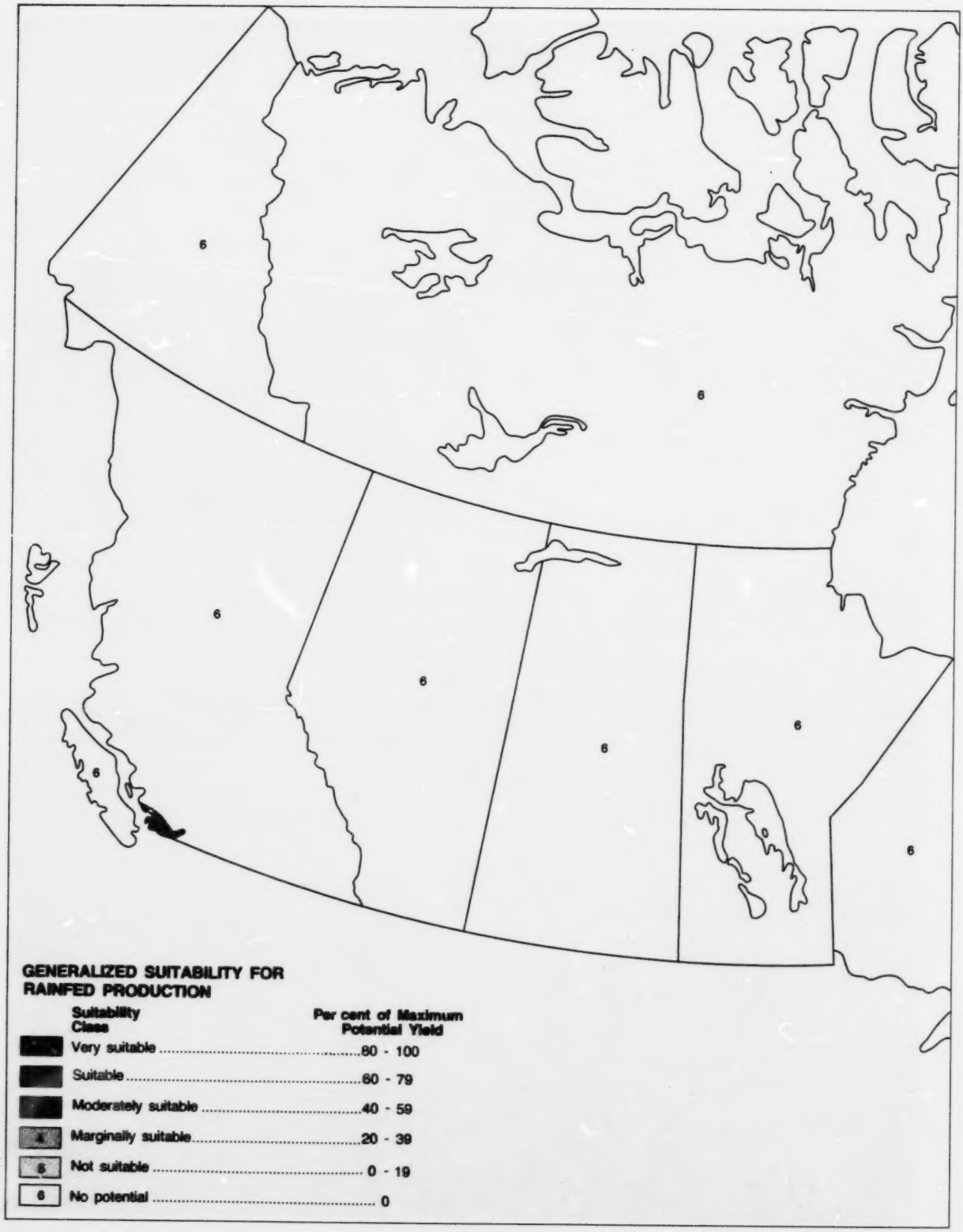
| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLACK CHERNOZEMIC | 0 | 0.0 | 0.0 | 591.2 | 6827.2 | 11163.6 | 727.1 | 0.0 | 71.7 | 0.0 | 0.0 | 19380.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 709.7 | 0.0 | 0.0 | 17.9 | 0.0 | 0.0 | 727.6 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 891.9 | 0.0 | 0.0 | 0.0 | 0.0 | 891.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 709.7 | 891.9 | 0.0 | 17.9 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.0-3.2 | 3.0-0.0 | 0.0-0.0 | 2.1-2.1 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | |
| DARK GRAY CHERNOZEMIC | 0 | 0.0 | 0.0 | 0.0 | 1842.4 | 2298.2 | 1353.4 | 0.0 | 0.0 | 0.0 | 0.0 | 5493.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51.0 | 0.0 | 0.0 | 0.0 | 0.0 | 51.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.7 | 0.0 | 0.0 | 0.0 | 0.0 | 12.7 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 63.7 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.2-0.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| GRAY BROWN LUVISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 307.3 | 829.6 | 0.0 | 0.0 | 836.6 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 37.3 | 0.0 | 0.0 | 37.3 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1771.4 | 1220.6 | 0.0 | 0.0 | 2991.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.7 | 1158.0 | 0.0 | 0.0 | 1172.8 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1786.2 | 2815.8 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.3-0.9 | 2.7-3.5 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | |
| GRAY LUVISOL | 0 | 6982.0 | 9212.9 | 13648.6 | 31812.6 | 15263.0 | 2458.1 | 286.6 | 0.0 | 0.0 | 0.0 | 77963.5 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 322.6 | 17.9 | 0.0 | 0.0 | 0.0 | 340.6 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 29.6 | 0.0 | 0.0 | 0.0 | 29.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 322.6 | 47.3 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.6-3.2 | 3.0-0.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | |
| HUMO-FERRIC PODZOL | 0 | 586.5 | 25517.1 | 22492.1 | 68856.2 | 66867.6 | 7666.9 | 4878.9 | 3565.9 | 3503.1 | 1556.8 | 202988.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 475.2 | 735.9 | 0.0 | 0.0 | 0.0 | 1211.1 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 169.2 | 136.8 | 26.3 | 0.0 | 0.0 | 332.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 644.4 | 872.7 | 26.3 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.9-0.2 | 1.7-0.5 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 5 | 12 | 1 | 0 | 0 | |
| MELANIC BRUNISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1449.7 | 781.1 | 0.0 | 0.0 | 2231.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 43.5 | 7.2 | 0.0 | 0.0 | 50.7 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 317.7 | 573.8 | 0.0 | 0.0 | 891.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 361.2 | 588.9 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-0.0 | 3.1-0.7 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 6 | 0 | 0 | |

TABLE 14 (cont)

EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** CORN **

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DYSTRIC BRUNISOL | 0 | 810.9 | 26787.5 | 800.5 | 1612.9 | 239.1 | 3599.8 | 302.2 | 0.0 | 0.0 | 480.9 | 34553.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 67.7 | 67.7 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 40.5 | 0.0 | 0.0 | 0.0 | 40.5 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.2 | 0.0 | 0.0 | 0.0 | 20.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 60.7 | 0.0 | 0.0 | 67.7 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.2-4.2 | 0.0-0.0 | 0.0-0.0 | 1.2-1.2 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | |
| CUMULIC REGOSOL | 0 | 0.0 | 0.0 | 3047.9 | 0.0 | 587.8 | 0.0 | 24.7 | 0.0 | 0.0 | 0.0 | 3660.4 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | 6.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.2 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.3-2.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| HUMIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 276.2 | 1492.1 | 133.5 | 81.8 | 65.6 | 0.0 | 0.0 | 2049.1 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 48.7 | 0.0 | 0.0 | 380.2 | 0.0 | 388.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 100.8 | 387.5 | 182.0 | 125.4 | 0.0 | 775.8 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 81.9 | 12.9 | 501.7 | 0.0 | 596.5 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 201.4 | 389.4 | 195.0 | 967.3 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.3-4.7 | 3.6-4.9 | 3.6-5.3 | 2.0-5.8 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 2 | 0 | |
| ORTHIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 6833.0 | 6226.8 | 1343.6 | 0.0 | 0.0 | 0.0 | 0.0 | 14402.4 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 107.3 | 0.0 | 0.0 | 0.0 | 0.0 | 107.3 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.2 | 0.0 | 0.0 | 0.0 | 13.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 107.3 | 13.2 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.3-2.9 | 4.7-4.7 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | |

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GENERALIZED SUITABILITY FOR RAINFED PRODUCTION
Suitability Class
Per cent of Maximum Potential Yield
Very suitable ..... 80 - 100
Suitable ..... 60 - 79
Moderately suitable ..... 40 - 59
4 Marginally suitable ..... 20 - 39
5 Not suitable ..... 0 - 19
6 No potential ..... 0

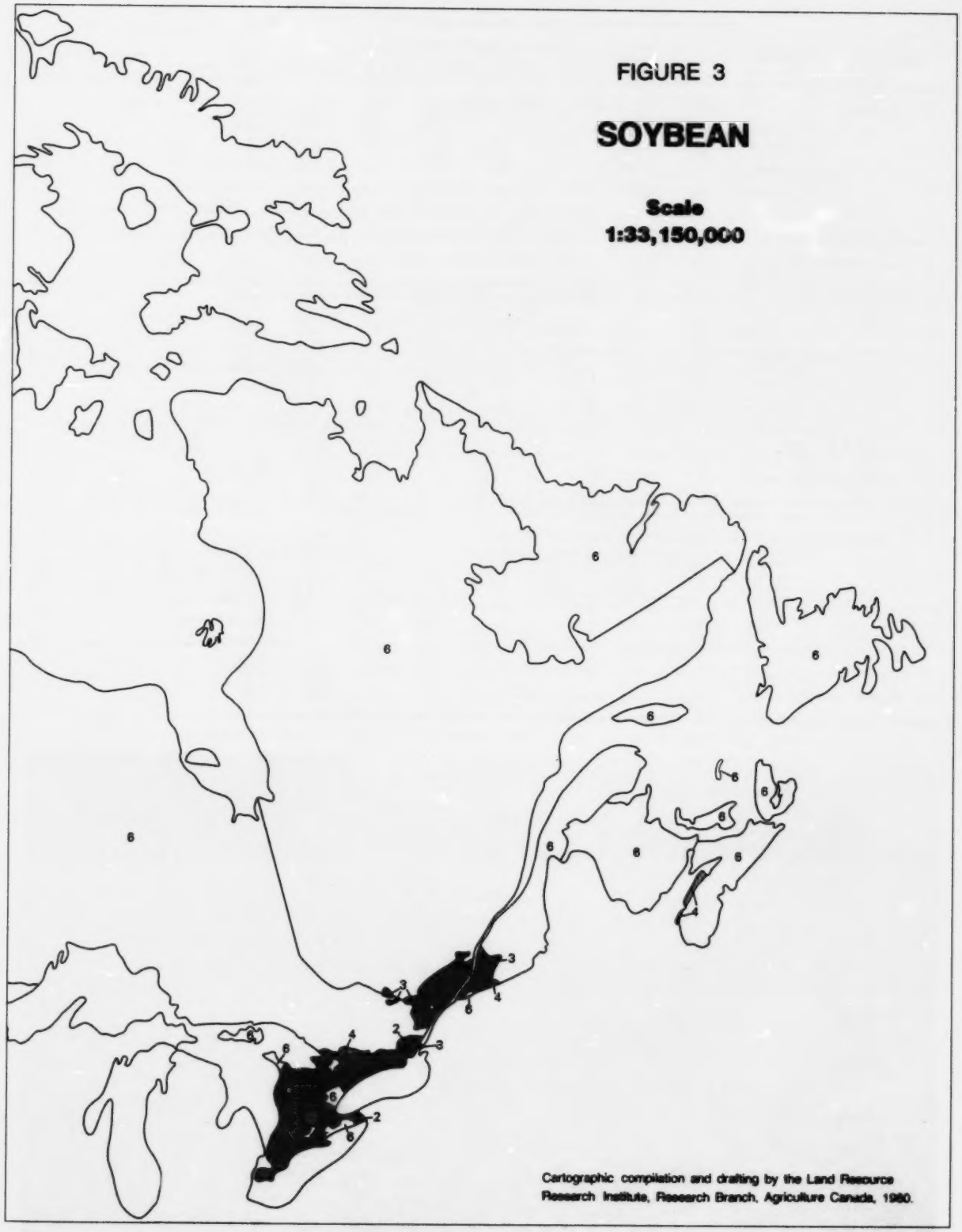


FIGURE 3
SOYBEAN
Scale
1:33,150,000
Cartographic compilation and drafting by the Land Resource
Research Institute, Research Branch, Agriculture Canada, 1980.

TABLE 15

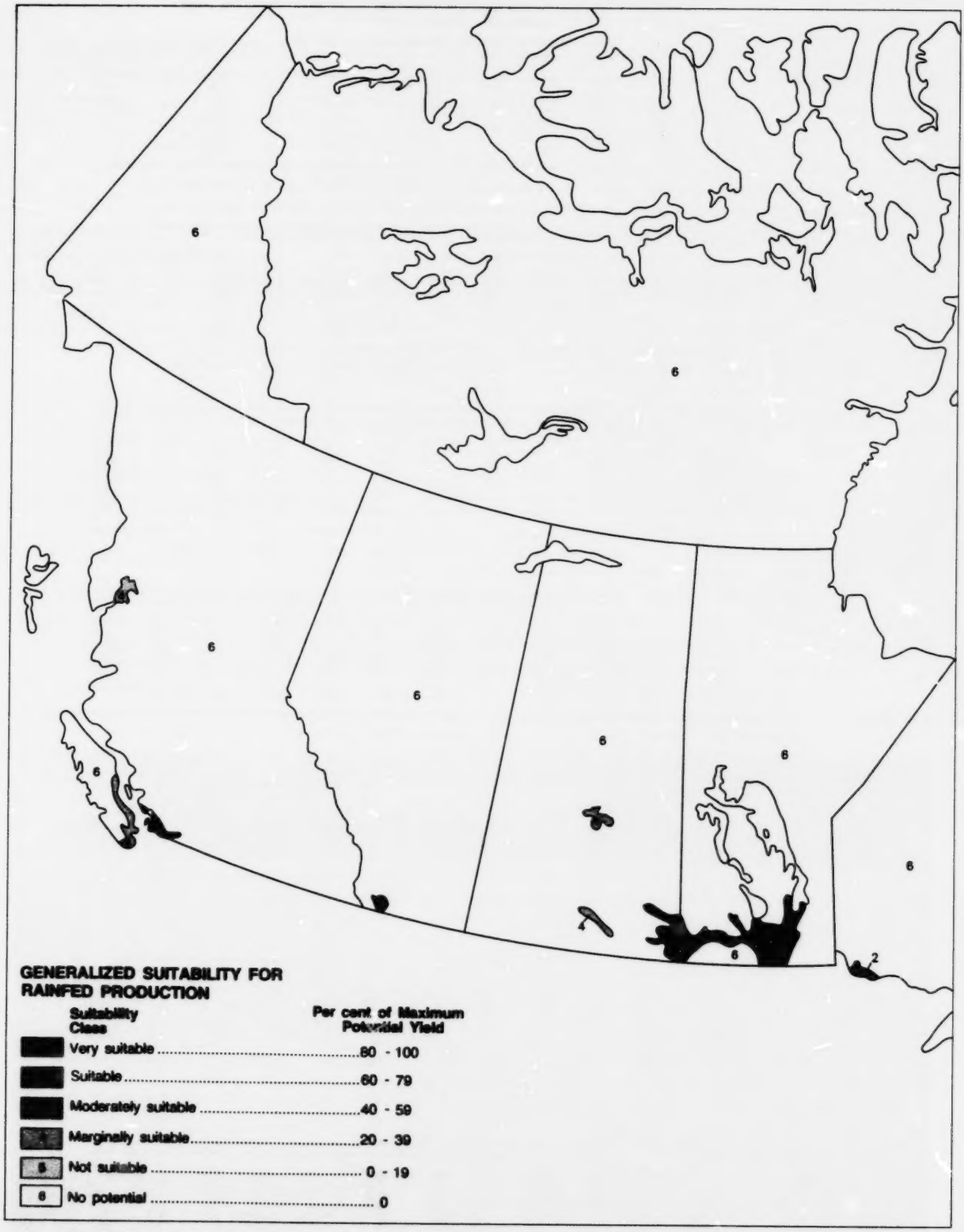
EXTENT OF LAND(THOUSANDS OF HECTARES) BY MAJOR CLIMATIC ZONES BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** SOYBEAN **

| MAJOR CLIMATIC ZONE | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH(DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CRYOBOREAL | 0 | 810.8 | 69004.7 | 57028.5 | 157293.9 | 104857.2 | 3871.5 | 1083.0 | 3563.7 | 1987.2 | 1089.2 | 400589.6 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| BOREAL | 0 | 0.0 | 0.0 | 0.0 | 7892.8 | 66256.1 | 15954.8 | 5070.3 | 0.0 | 1515.4 | 1024.9 | 98914.1 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 42.8 | 0.0 | 102.0 | 0.0 | 144.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 93.8 | 0.0 | 238.1 | 0.0 | 331.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 136.6 | 0.0 | 340.1 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.3-2.0 | 0.0-0.0 | 1.5-2.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 1 | 0 | |
| MESIC | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3353.6 | 2844.1 | 567.9 | 0.0 | 9987.5 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.1 | 5.1 | 0.0 | 0.0 | 10.2 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1585.3 | 1325.1 | 0.0 | 0.0 | 2910.4 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 428.3 | 1209.5 | 501.4 | 0.0 | 2139.4 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2018.8 | 2539.7 | 501.4 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.4-2.7 | 1.4-2.9 | 3.0-3.0 | 0.6-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 17 | 1 | 0 | |

TABLE 16

EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ++ SOYBEAN ++

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRAY BROWN LUVISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1037.1 | 1107.6 | 0.0 | 0.0 | 2144.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1126.3 | 971.7 | 0.0 | 0.0 | 2098.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 761.0 | 0.0 | 0.0 | 761.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1126.3 | 1737.8 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-2.3 | 1.0-2.7 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 7 | 0 | 0 | |
| GRAY LUVISOL | 0 | 4982.0 | 9212.0 | 13698.0 | 31812.0 | 15263.0 | 2780.0 | 206.0 | 0.0 | 0.0 | 0.0 | 77885.1 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.3 | 0.0 | 0.0 | 0.0 | 47.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 47.3 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.6-1.7 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | |
| HUMO-FERRIC PODZOL | 0 | 584.5 | 25517.1 | 22492.1 | 68556.2 | 64847.6 | 8851.3 | 5538.6 | 3548.9 | 3583.1 | 1556.8 | 204212.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33.8 | 0.0 | 0.0 | 0.0 | 33.8 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 97.3 | 0.0 | 0.0 | 0.0 | 97.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 82.1 | 26.3 | 0.0 | 0.0 | 108.5 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 313.2 | 26.3 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.4-2.5 | 2.4-2.4 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 0 | |
| MELANIC BRUNISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1505.2 | 782.1 | 0.0 | 0.0 | 2287.3 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.1 | 0.0 | 0.0 | 0.0 | 14.1 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 196.5 | 297.2 | 0.0 | 0.0 | 493.7 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 95.0 | 283.8 | 0.0 | 0.0 | 378.8 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 305.7 | 580.9 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.3-2.6 | 1.7-2.6 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 6 | 0 | 0 | |
| DYSTRIC BRUNISOL | 0 | 818.9 | 26797.5 | 888.5 | 1612.9 | 239.1 | 3999.0 | 382.2 | 0.0 | 0.0 | 660.6 | 36821.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.7 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.7 | 0.0 | 0.0 | 0.0 | 44.7 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 44.7 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.7-2.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| HUMIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 276.2 | 1492.1 | 335.1 | 81.0 | 65.6 | 185.4 | 0.0 | 2376.1 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 182.0 | 0.0 | 182.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 191.4 | 56.0 | 238.1 | 0.0 | 485.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 230.0 | 138.6 | 501.7 | 0.0 | 870.3 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 500.4 | 195.0 | 801.8 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-2.7 | 1.0-2.9 | 1.0-1.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 0 | |
| ORTHIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 6833.0 | 6220.0 | 1458.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14510.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.2 | 0.0 | 0.0 | 0.0 | 13.2 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.2 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-2.4 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |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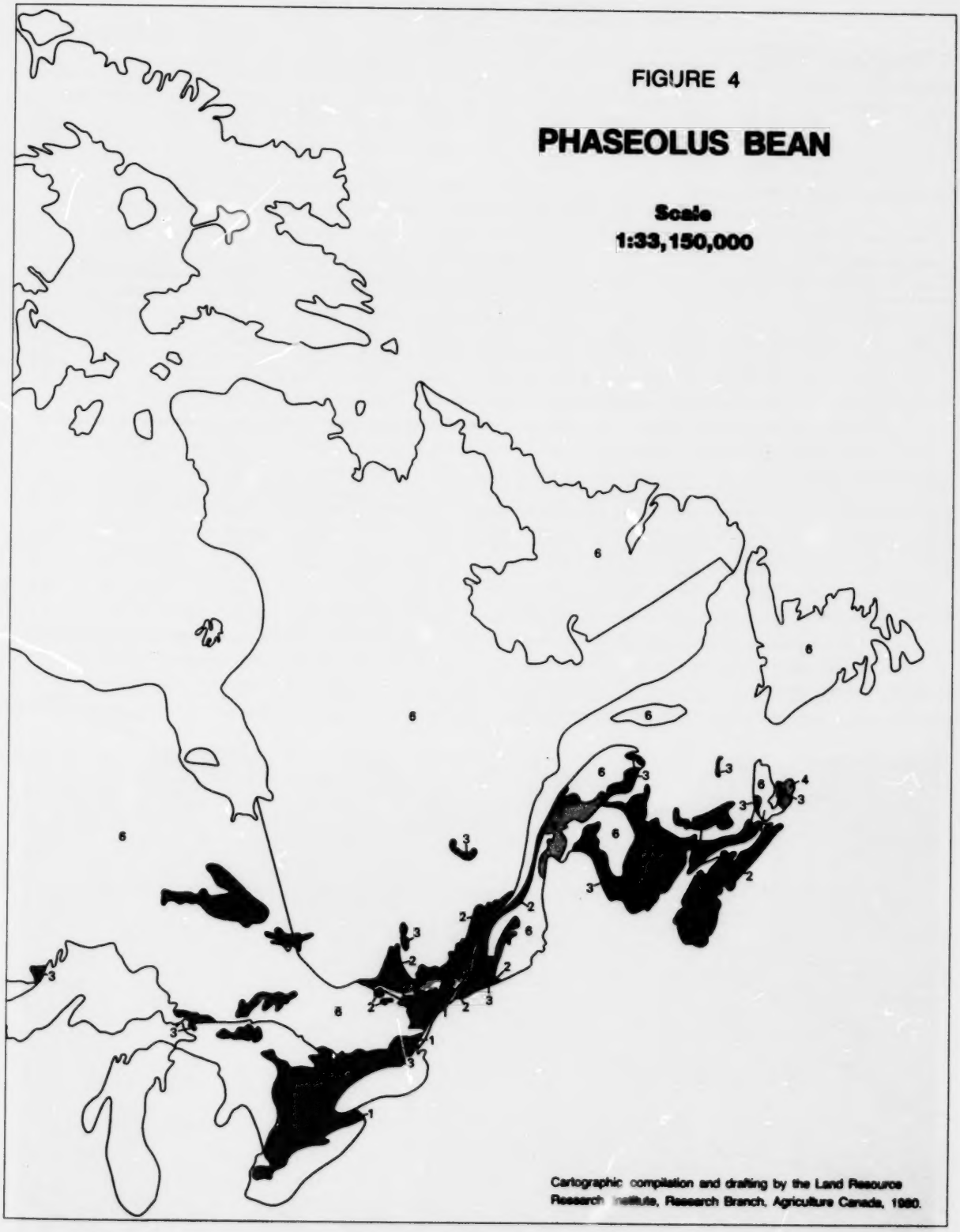
GENERALIZED SUITABILITY FOR RAINFED PRODUCTION
Suitability Class
Per cent of Maximum Potential Yield
Very suitable ..... 80 - 100
Suitable ..... 60 - 79
Moderately suitable ..... 40 - 59
Marginally suitable ..... 20 - 39
5 Not suitable ..... 0 - 19
0 No potential ..... 0

FIGURE 4

# PHASEOLUS BEAN

**Scale**
**1:33,150,000**



Cartographic compilation and drafting by the Land Resource Research Institute, Research Branch, Agriculture Canada, 1980.

TABLE 17

EXTENT OF LAND(THOUSANDS OF HECTARES) BY MAJOR CLIMATIC ZONES BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF **PHASEOLUS BEAN**

| MAJOR CLIMATIC ZONE | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH(DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CRYOBOREAL | 0 | 810.8 | 69804.7 | 37028.5 | 197106.8 | 103252.1 | 3688.5 | 976.8 | 3563.7 | 1987.2 | 1888.2 | 388870.1 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 32.7 | 133.0 | 19.7 | 26.2 | 0.0 | 0.0 | 0.0 | 211.6 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 74.3 | 871.8 | 163.3 | 80.1 | 0.0 | 0.0 | 0.0 | 1189.1 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 688.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 688.8 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 107.0 | 1685.2 | 183.0 | 106.3 | 0.0 | 0.0 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.5-2.0 | 1.5-2.0 | 1.0-2.2 | 1.2-2.1 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 2 | 10 | 5 | 3 | 0 | 0 | 0 | |
| BOREAL | 0 | 0.0 | 0.0 | 0.0 | 6983.3 | 65236.6 | 13537.9 | 6338.8 | 0.0 | 1515.4 | 889.5 | 95300.5 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 46.9 | 130.2 | 0.0 | 0.0 | 0.0 | 0.0 | 135.5 | 312.6 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 62.6 | 889.6 | 2050.8 | 568.5 | 0.0 | 102.0 | 0.0 | 3671.4 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 389.7 | 302.0 | 0.0 | 238.1 | 0.0 | 849.8 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.4 | 0.0 | 0.0 | 0.0 | 0.0 | 56.4 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 109.5 | 1019.6 | 2616.9 | 868.6 | 0.0 | 340.1 | 135.5 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-1.9 | 1.5-2.6 | 1.0-3.4 | 1.0-3.0 | 0.0-0.0 | 1.9-2.5 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 1 | 5 | 17 | 15 | 0 | 1 | 1 | |
| MESIC | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2689.9 | 1569.9 | 567.9 | 0.0 | 4803.7 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 38.8 | 0.0 | 0.0 | 0.0 | 38.8 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1026.9 | 868.1 | 0.0 | 0.0 | 1895.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1373.8 | 2101.7 | 581.6 | 0.0 | 4056.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 251.2 | 0.0 | 0.0 | 0.0 | 251.2 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 2682.8 | 3089.8 | 581.6 | 0.0 | |
| ANTIC, DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.5-3.4 | 1.9-3.3 | 3.1-3.1 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 29 | 1 | 0 | |

TABLE 18

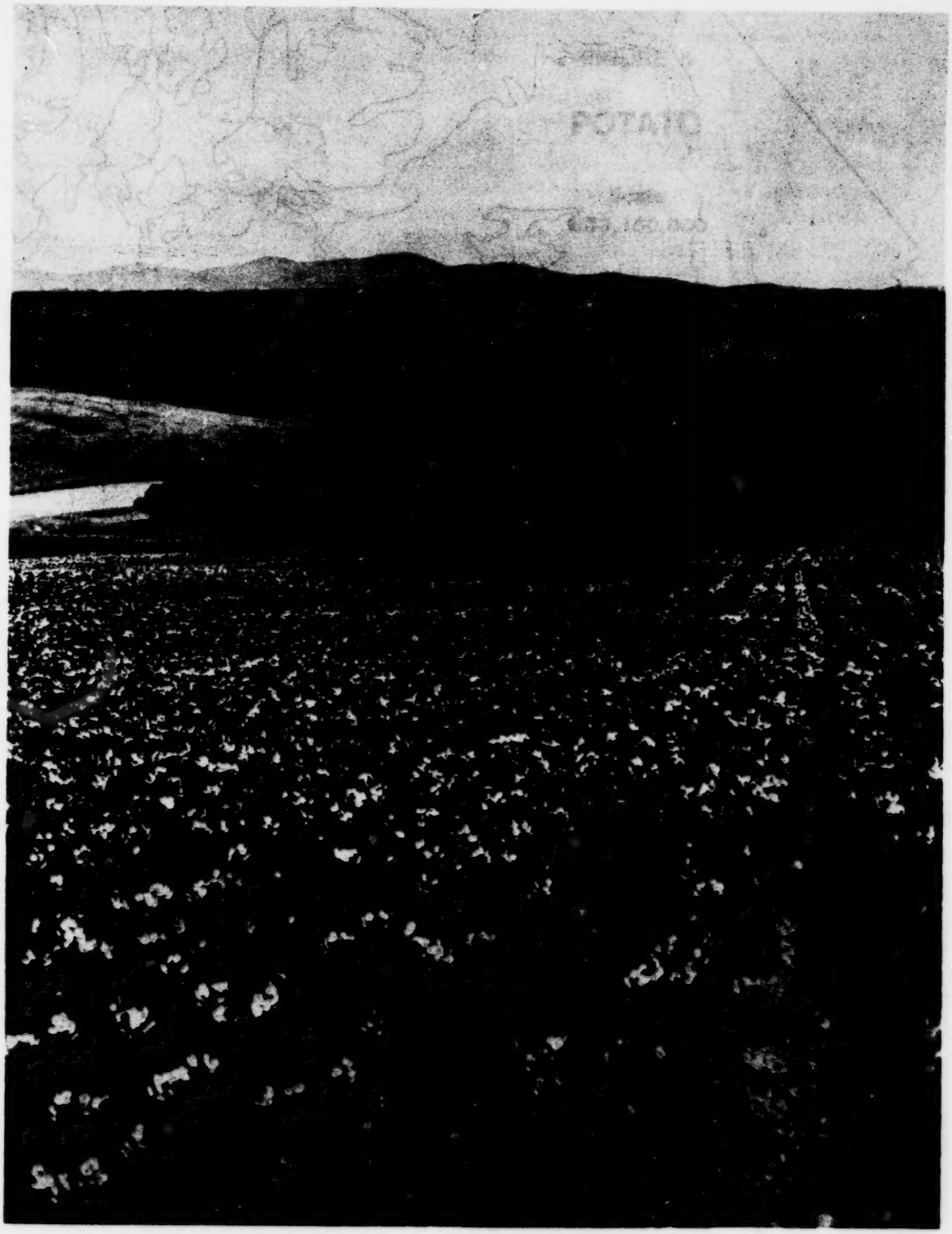
EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** PHAS,BEAN **

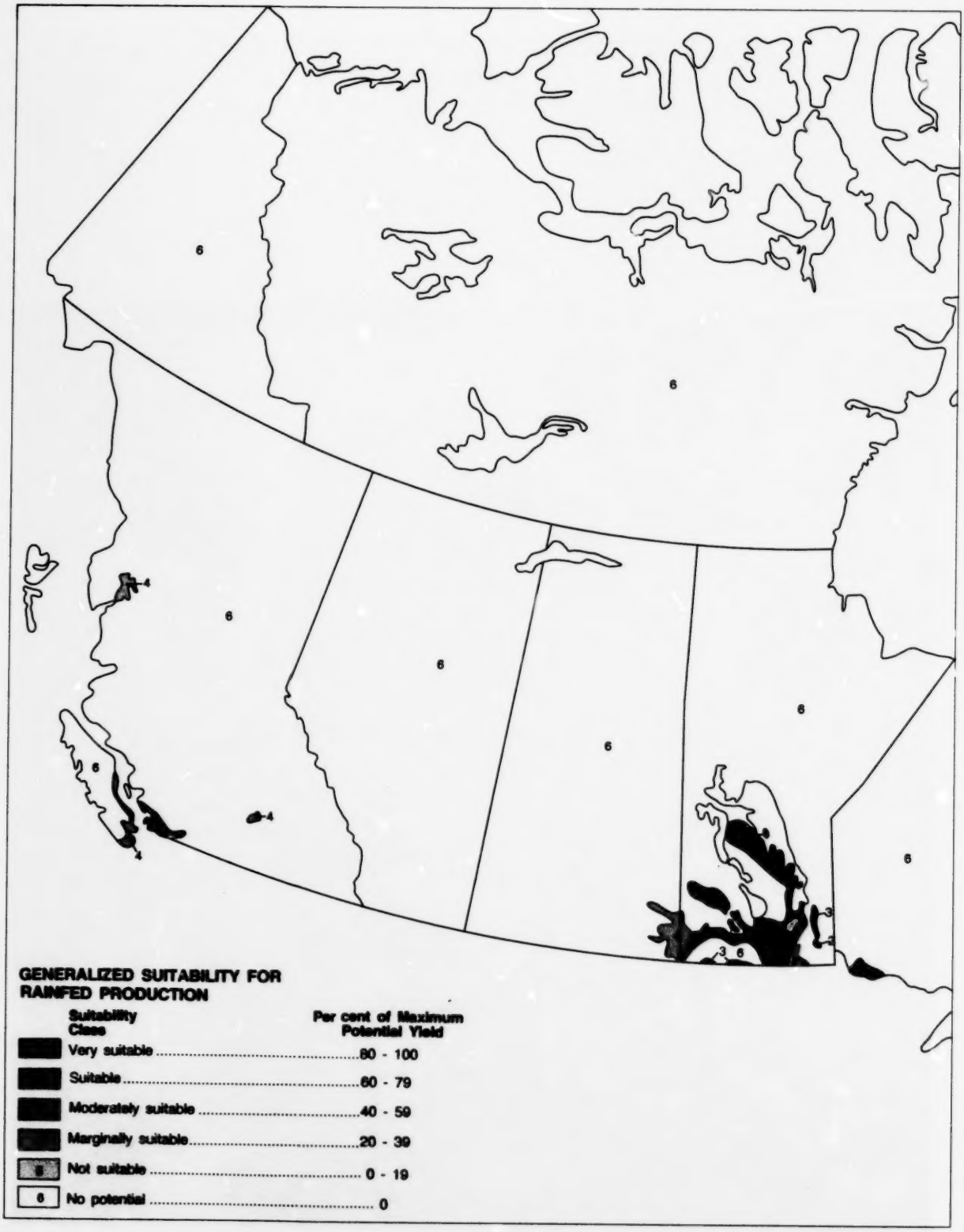
| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLACK CHERNOZEMIC | 0 | 0.0 | 0.0 | 991.2 | 6317.7 | 11090.0 | 1109.0 | 0.0 | 80.6 | 0.0 | 0.0 | 19197.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 46.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 46.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 62.6 | 783.4 | 509.7 | 0.0 | 0.0 | 0.0 | 0.0 | 1355.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 109.5 | 783.4 | 509.7 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.0-1.9 | 1.9-2.0 | 2.2-2.2 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | |
| GRAY BROWN LUVISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 415.5 | 560.9 | 0.0 | 0.0 | 976.4 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 702.8 | 514.7 | 0.0 | 0.0 | 1217.5 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1065.1 | 1769.7 | 0.0 | 0.0 | 2834.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1767.9 | 2284.3 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.1-3.1 | 1.0-3.3 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 19 | 0 | 0 | |
| GRAY LUVISOL | 0 | 4982.8 | 9212.9 | 13648.4 | 31883.6 | 16921.5 | 1841.2 | 207.2 | 0.0 | 0.0 | 0.0 | 78617.4 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 103.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 103.1 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 218.9 | 808.3 | 3.4 | 0.0 | 0.0 | 0.0 | 1030.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 131.1 | 41.3 | 0.0 | 0.0 | 0.0 | 172.4 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 322.0 | 939.4 | 44.7 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-2.0 | 1.5-2.4 | 1.0-2.6 | 2.5-2.5 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 1 | 3 | 5 | 3 | 0 | 0 | 0 | |
| HUMO-FERRIC PODZOL | 0 | 584.5 | 25517.1 | 22492.1 | 68556.2 | 63838.7 | 7303.1 | 4888.2 | 3565.9 | 3503.1 | 1556.8 | 201008.7 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 133.0 | 19.7 | 0.0 | 0.0 | 0.0 | 0.0 | 152.7 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 274.0 | 559.1 | 677.5 | 0.0 | 0.0 | 0.0 | 1511.7 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 600.9 | 169.2 | 345.9 | 26.3 | 0.0 | 0.0 | 1102.3 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1008.8 | 748.2 | 1065.4 | 26.3 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.5-2.8 | 1.0-3.2 | 1.0-3.1 | 3.0-3.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 4 | 8 | 16 | 1 | 0 | 0 | |
| MELANIC BRUNISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1558.5 | 808.5 | 0.0 | 0.0 | 2367.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 240.4 | 297.2 | 0.0 | 0.0 | 537.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.9 | 257.4 | 0.0 | 0.0 | 269.3 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 252.3 | 554.6 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.2-3.1 | 2.1-3.2 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 6 | 0 | 0 | |
| DYSTRIC BRUNISOL | 0 | 818.9 | 26787.5 | 888.5 | 1514.7 | 239.1 | 3668.9 | 276.1 | 0.0 | 0.0 | 333.2 | 34826.0 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 32.7 | 0.0 | 0.0 | 28.2 | 0.0 | 0.0 | 135.5 | 196.4 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 65.5 | 0.0 | 136.9 | 48.5 | 0.0 | 0.0 | 0.0 | 250.8 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.2 | 0.0 | 0.0 | 0.0 | 20.2 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 98.2 | 0.0 | 136.9 | 96.9 | 0.0 | 0.0 | 135.5 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.5-2.0 | 0.0-0.0 | 1.0-2.3 | 1.2-3.2 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 1 | 0 | 4 | 2 | 0 | 0 | 1 | |

TABLE 18 (cont)

EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** PHAS.BEAN **

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CUMULIC REGOSOL | 0 | 0.0 | 0.0 | 3087.9 | 0.0 | 587.8 | 0.0 | 21.6 | 0.0 | 0.0 | 0.0 | 3697.3 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 9.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.9-1.9 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| HUMIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 276.2 | 1466.0 | 174.2 | 51.0 | 65.6 | 129.4 | 0.0 | 2157.3 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 27.1 | 0.0 | 30.8 | 0.0 | 0.0 | 0.0 | 57.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 95.0 | 0.0 | 56.4 | 102.0 | 0.0 | 253.4 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 151.4 | 138.6 | 739.8 | 0.0 | 1039.2 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.4 | 238.0 | 0.0 | 0.0 | 0.0 | 294.4 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 27.1 | 160.8 | 420.2 | 195.0 | 841.8 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.5-1.5 | 2.0-3.4 | 1.5-3.4 | 2.5-3.3 | 1.9-3.1 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 1 | 2 | 4 | 3 | 2 | 0 | |
| ORTHIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 6833.0 | 5742.2 | 1343.6 | 0.0 | 0.0 | 0.0 | 0.0 | 13918.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 483.9 | 107.3 | 0.0 | 0.0 | 0.0 | 0.0 | 591.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.2 | 0.0 | 0.0 | 0.0 | 13.2 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 483.9 | 107.3 | 13.2 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 1.8-2.1 | 2.6-2.5 | 3.3-3.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 0 | |


POTATO




**GENERALIZED SUITABILITY FOR RAINFED PRODUCTION**

| Suitability Class | Per cent of Maximum Potential Yield |
|---|---|
| Very suitable | 80 - 100 |
| Suitable | 60 - 79 |
| Moderately suitable | 40 - 59 |
| Marginally suitable | 20 - 39 |
| Not suitable | 0 - 19 |
| 6 No potential | 0 |

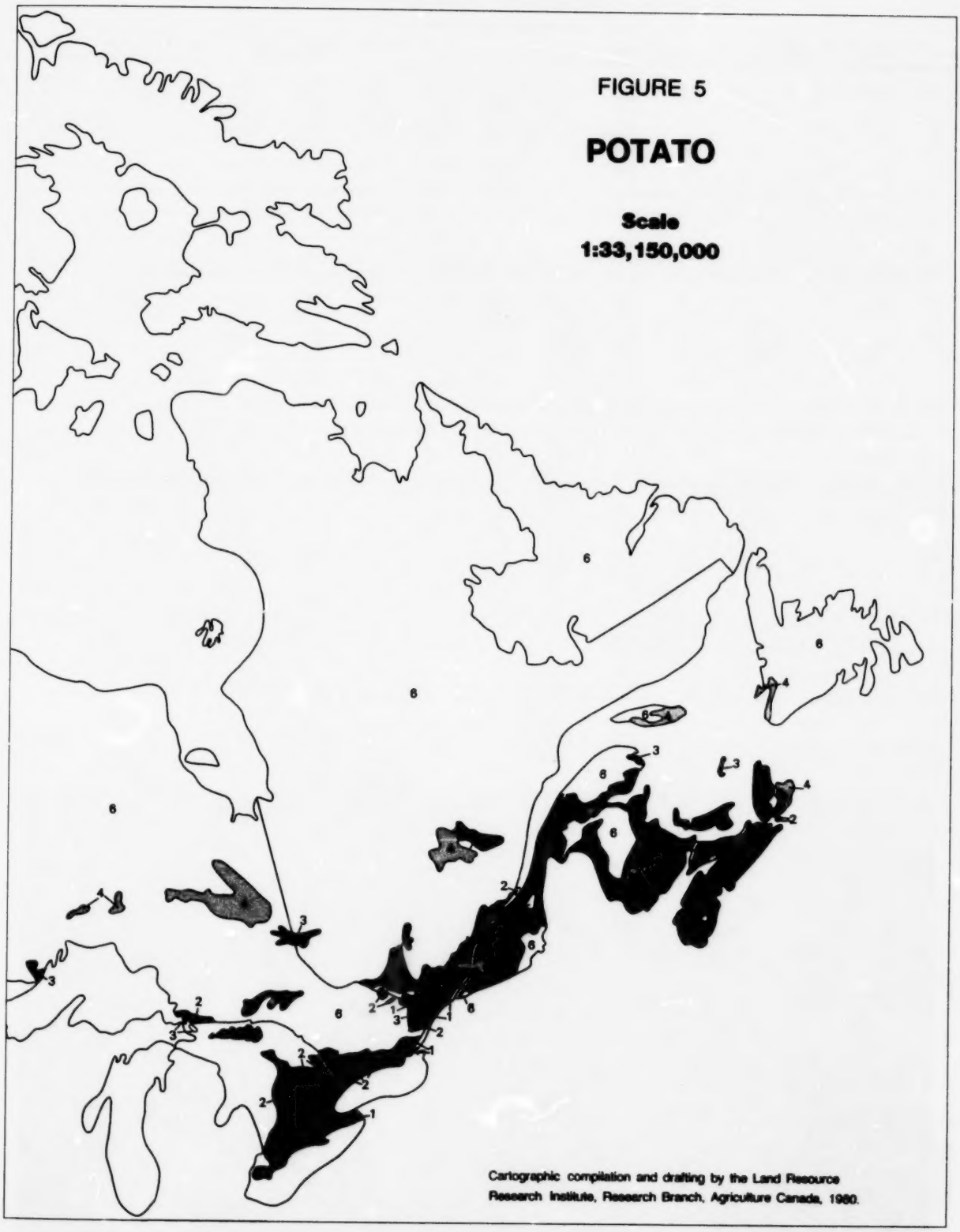


FIGURE 5
POTATO
Scale
1:33,150,000
Cartographic compilation and drafting by the Land Resource
Research Institute, Research Branch, Agriculture Canada, 1980.

TABLE 19

EXTENT OF LAND(THOUSANDS OF HECTARES) BY MAJOR CLIMATIC ZONES BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** POTATO **

| MAJOR CLIMATIC ZONE | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH(DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CRYOBOREAL | 0 | 810.8 | 69884.7 | 57028.5 | 156938.4 | 103252.1 | 3482.0 | 976.8 | 3583.7 | 1987.2 | 1008.2 | 398024.4 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 138.0 | 471.1 | 134.0 | 26.2 | 0.0 | 0.0 | 0.0 | 769.3 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 217.3 | 1134.2 | 234.3 | 80.1 | 0.0 | 0.0 | 0.0 | 1665.8 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.1 | 0.0 | 0.0 | 0.0 | 0.0 | 21.1 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 355.3 | 1605.2 | 389.5 | 106.3 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-3.9 | 3.1-4.9 | 2.7-5.3 | 2.6-4.4 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 8 | 10 | 8 | 3 | 0 | 0 | 0 | |
| BOREAL | 0 | 0.0 | 0.0 | 0.0 | 7092.8 | 64787.1 | 12485.6 | 4267.1 | 0.0 | 1515.4 | 889.5 | 91037.2 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 476.4 | 0.0 | 0.0 | 0.0 | 0.0 | 135.5 | 611.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 992.6 | 2563.2 | 604.9 | 0.0 | 102.0 | 0.0 | 4262.8 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 906.0 | 334.9 | 0.0 | 238.1 | 0.0 | 1479.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1469.0 | 3469.2 | 939.8 | 0.0 | 340.1 | 135.5 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.3-4.8 | 3.5-4.6 | 3.7-4.3 | 0.0-0.0 | 4.0-5.4 | 1.9-1.9 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 6 | 25 | 14 | 0 | 1 | 1 | |
| MESIC | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3250.9 | 1928.0 | 567.9 | 0.0 | 5346.7 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 17.9 | 0.0 | 0.0 | 17.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1383.1 | 613.7 | 0.0 | 0.0 | 1996.8 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 487.1 | 1497.0 | 501.6 | 0.0 | 2485.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 251.2 | 949.1 | 0.0 | 0.0 | 1200.3 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2121.4 | 3077.7 | 501.6 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 4.5-7.0 | 3.2-6.8 | 6.3-6.3 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 21 | 1 | 0 | |

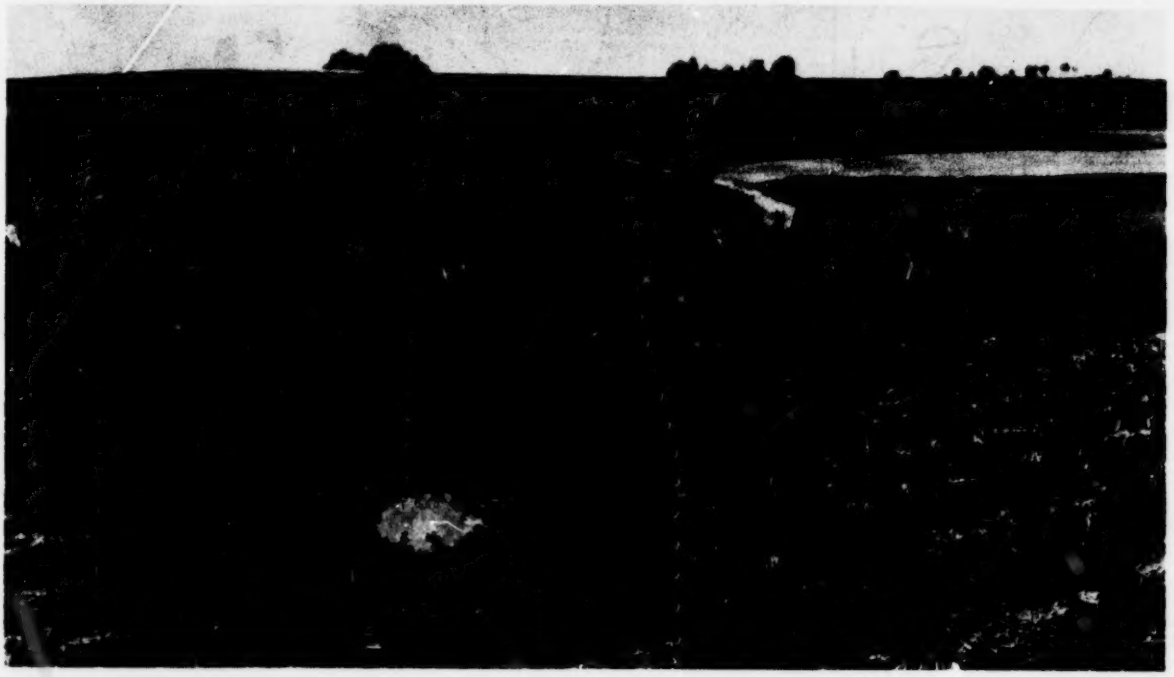


TABLE 20

EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** POTATO **

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLACK CHERNOZEMIC | 0 | 0.0 | 0.0 | 591.2 | 6427.2 | 10863.4 | 798.8 | 0.0 | 71.7 | 0.0 | 0.0 | 18862.3 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 476.5 | 0.0 | 0.0 | 17.9 | 0.0 | 0.0 | 494.4 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 533.5 | 400.5 | 0.0 | 0.0 | 0.0 | 0.0 | 934.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 509.7 | 0.0 | 0.0 | 0.0 | 0.0 | 509.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 1010.0 | 910.2 | 0.0 | 17.9 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.3-4.8 | 3.5-5.3 | 0.0-0.0 | 3.2-3.2 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | |
| DARK GRAY CHERNOZEMIC | 0 | 0.0 | 0.0 | 0.0 | 1842.6 | 2290.2 | 1682.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5814.5 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 102.0 | 0.0 | 0.0 | 0.0 | 0.0 | 102.0 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 33.1 | 0.0 | 0.0 | 0.0 | 0.0 | 33.1 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 135.2 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.6-5.7 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | |
| GRAY BROWN LUVISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1063.3 | 560.9 | 0.0 | 0.0 | 1624.2 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1031.1 | 436.9 | 0.0 | 0.0 | 1467.9 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 89.0 | 1136.7 | 0.0 | 0.0 | 1225.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 710.8 | 0.0 | 0.0 | 710.8 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1120.1 | 2284.3 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 4.4-5.8 | 4.0-6.7 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 10 | 0 | 0 | |
| GRAY LUVISOL | 0 | 4982.8 | 9212.9 | 13648.4 | 31767.0 | 14671.4 | 1657.7 | 189.3 | 0.0 | 0.0 | 0.0 | 76129.2 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 18.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18.9 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 26.5 | 572.0 | 991.8 | 0.0 | 0.0 | 0.0 | 0.0 | 1590.4 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 131.1 | 62.6 | 0.0 | 0.0 | 0.0 | 193.7 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 45.4 | 572.0 | 1123.0 | 62.6 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.0-3.5 | 3.6-4.3 | 3.7-5.1 | 5.0-5.1 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 2 | 4 | 5 | 3 | 0 | 0 | 0 | |
| HUMO-FERRIC PODZOL | 0 | 584.3 | 25517.1 | 22492.1 | 68365.9 | 63838.7 | 4990.9 | 4637.9 | 3565.9 | 3583.1 | 1556.8 | 201052.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 86.4 | 0.0 | 19.7 | 0.0 | 0.0 | 0.0 | 0.0 | 106.1 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 103.9 | 1008.8 | 871.5 | 719.3 | 0.0 | 0.0 | 0.0 | 2703.6 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 169.2 | 394.4 | 24.3 | 0.0 | 0.0 | 589.9 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 190.3 | 1008.8 | 1060.4 | 1113.7 | 24.3 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.8-3.9 | 3.6-4.9 | 2.7-6.1 | 3.7-6.6 | 6.2-6.2 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 4 | 4 | 12 | 17 | 1 | 0 | 0 | |
| MELANIC BRUNISOL | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1441.0 | 808.5 | 0.0 | 0.0 | 2249.5 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 268.4 | 176.9 | 0.0 | 0.0 | 445.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 101.5 | 257.4 | 0.0 | 0.0 | 358.9 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 120.3 | 0.0 | 0.0 | 120.3 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 369.9 | 554.6 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 4.0-6.3 | 4.4-6.7 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 6 | 0 | 0 | |

TABLE 20 (cont)

EXTENT OF LAND (THOUSANDS OF HECTARES) BY MAJOR SOIL GROUP BY GROWING SEASON LENGTH VARIOUSLY SUITED FOR THE PRODUCTION OF ** POTATO **

| MAJOR SOIL GROUP | % RANGE OF MAX POT YLD | GROWING SEASON LENGTH (DAYS) 0 | 1-74 | 75-89 | 90-104 | 105-119 | 120-134 | 135-149 | 150-164 | 165-179 | >180 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EUTRIC BRUNISOL | 0 | 24916.0 | 25021.6 | 1580.7 | 4751.1 | 1047.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 57316.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 21.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.4 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 21.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.4-3.4 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | |
| DYSTRIC BRUNISOL | 0 | 810.9 | 26787.5 | 880.5 | 1514.7 | 239.1 | 3319.0 | 276.1 | 0.0 | 0.0 | 333.2 | 34868.9 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 32.7 | 0.0 | 116.4 | 28.2 | 0.0 | 0.0 | 135.5 | 308.8 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 65.5 | 0.0 | 145.3 | 40.5 | 0.0 | 0.0 | 0.0 | 251.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.1 | 20.2 | 0.0 | 0.0 | 0.0 | 41.4 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 98.2 | 0.0 | 280.7 | 88.9 | 0.0 | 0.0 | 135.5 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 2.7-3.4 | 0.0-0.0 | 3.2-5.1 | 2.6-4.5 | 0.0-0.0 | 0.0-0.0 | 1.9-1.9 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 1 | 0 | 3 | 2 | 0 | 0 | 1 | |
| ORTHIC REGOSOL | 0 | 0.0 | 6833.6 | 2358.7 | 1503.1 | 815.6 | 268.6 | 17.3 | 0.0 | 0.0 | 0.0 | 10988.6 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.3 | 0.0 | 0.0 | 0.0 | 0.0 | 13.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19.9 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.8-5.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| CUMULIC REGOSOL | 0 | 0.0 | 0.0 | 3067.9 | 0.0 | 587.4 | 0.0 | 18.5 | 0.0 | 0.0 | 0.0 | 3694.3 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.3 | 0.0 | 0.0 | 0.0 | 9.3 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.1 | 0.0 | 0.0 | 0.0 | 3.1 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.3 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-5.3 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| HUMIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 276.2 | 1492.1 | 112.5 | 81.8 | 68.6 | 125.8 | 0.0 | 2153.5 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 166.2 | 0.0 | 0.0 | 102.0 | 0.0 | 268.2 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.4 | 151.4 | 76.8 | 739.8 | 0.0 | 1024.4 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 238.0 | 118.2 | 0.0 | 0.0 | 356.2 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 222.6 | 389.4 | 195.0 | 841.8 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.6-6.6 | 5.2-7.0 | 5.1-6.8 | 4.0-6.3 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 0 | |
| ORTHIC GLEYSOL | 0 | 0.0 | 0.0 | 0.0 | 6833.0 | 5742.2 | 1343.6 | 0.0 | 0.0 | 0.0 | 0.0 | 13918.8 |
| | 1-19% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 20-39% | 0.0 | 0.0 | 0.0 | 0.0 | 471.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 471.1 |
| | 40-59% | 0.0 | 0.0 | 0.0 | 0.0 | 12.7 | 107.3 | 0.0 | 0.0 | 0.0 | 0.0 | 120.1 |
| | 60-79% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | >80% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.2 | 0.0 | 0.0 | 0.0 | 13.2 |
| | TOTAL | 0.0 | 0.0 | 0.0 | 0.0 | 483.9 | 107.3 | 13.2 | 0.0 | 0.0 | 0.0 | |
| ANTIC. DM YLD RANGE(T/HA) | | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 0.0-0.0 | 3.1-3.4 | 4.3-6.7 | 6.9-6.9 | 0.0-4.0 | 0.0-0.0 | 0.0-0.0 | |
| NO. OF NONE ZERO MAP UNITS | | 0 | 0 | 0 | 0 | 5 | 2 | 1 | 0 | 0 | 0 | |

## 3.5 ESTIMATES OF PRODUCTION POTENTIAL

Estimates of production potential were made on a provincial basis for Quebec, Ontario, Manitoba, Saskatchewan and Alberta. Collectively these provinces account for 98 per cent of total field crop area, almost 100 per cent of Canadian production of spring wheat, corn, soybean and phaseolus bean, and approximately 50 per cent of the potato production (Statistics Canada, 1977). The remaining potato production comes essentially from the Atlantic provinces. The estimates were compiled by integrating the map unit boundaries with provincial boundaries and incrementing the yields and areas suitable for each crop for all map units within the provincial boundaries. Results are shown in Table 21.

The anticipated production values in Table 21 assume that all lands suited for each crop are used for that crop each year, that optimal management is practised, that crop losses due to pests, diseases and harvesting are minimal, and that weather conditions in any one year approximate 30 year normal climate. None of these assumptions is valid and thus corrections must be applied where possible. Unfortunately, the procedure cannot account for varying management, crop losses or weather at this point in time. However, adjustments can be made for the amount of land used for each crop considering that in Canada only one crop can be obtained from a given area in any one year (climatic conditions preclude double cropping on a commercial scale). Thus the production values in Table 21 can be adjusted by comparing with current crop distribution patterns (Table 22).

A casual comparison of the values in Tables 21 and 22 would indicate vast potentials still uptapped. This, however, would be erroneous, as shown in Table 23. In Table 23, anticipated production values are corrected for the proportion of field crop area currently utilized for that crop (Statistics Canada, 1977). This is done on the assumption that current crop distribution patterns are a reasonable approximation of crop substitution due to comparative economic advantage and environmental crop adaptability. On this basis anticipated Canadian production of spring wheat would be approximately 31 million tonnes, grain corn 6 million tonnes, soybean and phaseolus bean each about one half million tonnes, and potato just over 2 million tonnes (assuming that the five provinces considered account for about 50 per cent of total potato production). A large residual potential exists for spring wheat in the three prairie provinces, but apart from southern Manitoba there is minimal additional potential in these areas for the other crops. Similarily a considerable residual potential exists in Ontario for corn, soybean and phaseolus bean, but not for spring wheat or potato. Quebec has minimal residual potential for all crops on the basis of these calculations.

The above conclusions reflect the assumption that current cropping patterns will remain in the future, and this need not be the case. The data in Table 21 and the maps accompanying this section indicate areas where crop expansion could occur. However, since almost all easily tillable land is currently in production, the expansion of one crop will mean a corresponding reduction in area for other crops (or land use). For example, Acton, Dumanski and Stewart (1980) using

Table 21. ESTIMATED TOTAL AREA OF LAND (MILLIONS OF HECTARES) SUITED FOR EACH CROP[1], AND ESTIMATED ANTICIPATED PRODUCTION[2] (MILLIONS OF TONNES).

| | Spring Wheat | | Corn | | Soybean | | Ph. Bean | | Potato | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Area | Pot. Prod. | Area | Pot. Prod. | Area | Pot. Prod. | Area | Pot. Prod. | Area | Pot. Prod. |
| Quebec | 3.6 | 13.0 | 1.1 | 5.2 | 0.7 | 1.8 | 1.9 | 5.9 | 2.4 | 36.3 |
| Ontario | 8.7 | 34.9 | 6.0 | 32.5 | 4.4 | 12.0 | 6.4 | 20.2 | 6.0 | 98.1 |
| Manitoba | 6.3 | 22.8 | 1.8 | 8.0 | - | - | 1.0 | 2.6 | 2.2 | 28.7 |
| Sask. | 19.8 | 44.9 | - | - | - | - | 0.5 | 1.0 | 0.4 | 5.0 |
| Alberta | 16.2 | 32.3 | - | - | - | - | 0.1 | 0.1 | - | - |
| Totals | 55.8 | 147.9 | 8.9 | 45.7 | 5.1 | 13.8 | 9.9 | 29.8 | 11.0 | 178.1 |

1. This includes all areas classed as marginally suited and better
2. Anticipated production is the summation of anticipated yield for each map unit multiplied by the area of suited land in each unit, and incremented on a provincial basis.

Table 22. CROPS ON CENSUS FARMS, 1976 (MILLIONS OF HECTARES) AND MEAN ANNUAL PRODUCTION, 1974-76 INCLUSIVE (MILLIONS OF TONNES)

| | Wheat | | | | Corn | | Soybean | | Ph. Bean | | Potato | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area | | Production | | | | | | | | | |
| | Sp. Wht. | Total Wht. | Sp. Wht. | Total Wht. | Area | Prod. | Area | Prod. | Area | Prod. | Area | Prod. |
| Quebec | 0.03 | 0.03 | -[1] | 0.06 | 0.06 | 0.29 | <0.01 | - | <0.01 | - | 0.02 | 0.36 |
| Ontario | 0.01 | 0.21 | 0.01 | 0.60 | 0.64 | 2.97 | 0.15 | 0.30 | 0.01 | 0.09 | 0.02 | 0.45 |
| Manitoba | 1.45 | 1.54 | 2.16 | 2.16[2] | 0.01 | 0.02 | <0.01 | - | <0.01 | - | 0.01 | 0.21 |
| Sask. | 5.97 | 7.16 | 11.15 | 11.15[2] | <0.01 | - | <0.01 | - | <0.01 | - | <0.01 | 0.02 |
| Alberta | 1.99 | 2.24 | 3.77 | 3.77[2] | 0.01 | - | <0.01 | - | <0.01 | - | 0.01 | 0.17[3] |
| Totals | 9.45 | 11.18 | 17.09 | 17.74 | 0.72 | 3.28 | 0.15 | 0.30 | 0.01 | 0.09 | 0.06 | 1.21 |

1. Values for spring wheat are not available for Quebec.
2. Only minimal amounts of other wheats are produced in these provinces.
3. Produced mostly under irrigation.

Table 23. MEAN PROPORTION OF FIELD CROP AREA USED, 1974-76 INCLUSIVE (%) AND CORRESPONDING ANTICIPATED PRODUCTION (MILLIONS OF TONNES).

| | Sp. Wheat | | Corn | | Soybean | | Ph. Bean | | Potato | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % | Antic. Prod. | % | Antic. Prod. | % | Antic. Prod. | % | Antic. Prod. | % | Antic. Prod. |
| Quebec | 0.7 | 0.09 | 3.7 | 0.19 | - | - | - | - | 1.3 | 0.47 |
| Ontario | 0.1 | 0.04 | 18.4 | 5.98 | 5.1 | 0.61 | 2.1 | 0.42 | 0.6 | 0.59 |
| Manitoba | 35.9 | 6.72[1] | 0.1 | 0.01 | - | - | - | - | 0.4 | 0.12 |
| Sask. | 61.5 | 17.21[1] | - | - | - | - | - | - | - | - |
| Alberta | 27.4 | 6.89[1] | - | - | - | - | - | - | - | - |
| Totals | | 30.95 | | 6.18 | | 0.61 | | 0.42 | | 1.18 |

1. Spring wheat values have been adjusted for summerfallow on the following basis: Manitoba 17.9 per cent; Saskatchewan 38.0 per cent; Alberta 22.1 per cent (see appendix Table 3).

data from this report, estimated spring wheat production in the prairie provinces at approximately 50 million tonnes per year. This was achieved by reducing summerfallow and restricting the area allowed for other crops. Similar scenarios could be developed for other crops.

The data produced in this study provide a means of calculating crop production potentials, but they can also be used for assessing possibilities for crop diversification. For example the portion of the Great Plains with the highest potential for diversification is southern Manitoba; the remainder of this area is suited only for spring wheat (relative to the crops studied). Considerable possibilities exist for the expansion of corn, phaseolus bean and potato in southern Manitoba (Table 21) as well as for spring wheat. However, the figures in Table 21 are not additive, and an increase in area for any one crop can be achieved only at the expense of another crop.

The areas with the highest potential for crop diversification in Canada are southwestern Ontario, eastern Ontario, southern Quebec and a small part of British Columbia. These are the only areas with medium to high land suitability for all crops studied. Collectively these areas, with only 16 per cent of cultivated land, accounted for 46 per cent of total agricultural sales in 1971. At the same time the rate of conversion of agricultural land to urban and transportation uses is higher in these areas that in any other region of Canada*. Continuation of current trends and practices could have serious implications for the future, not only from the standpoint of crop diversity but also for total production potential. Land areas with high yield potentials and suitable for a wide variety of crops are unique, nonrenewable natural resources. These areas require protection to prevent their conversion to nonagricultural uses from which they could never be recovered.

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* The appendix to this report carries a full discussion on current agricultural land use patterns in Canada and their implications for the future.

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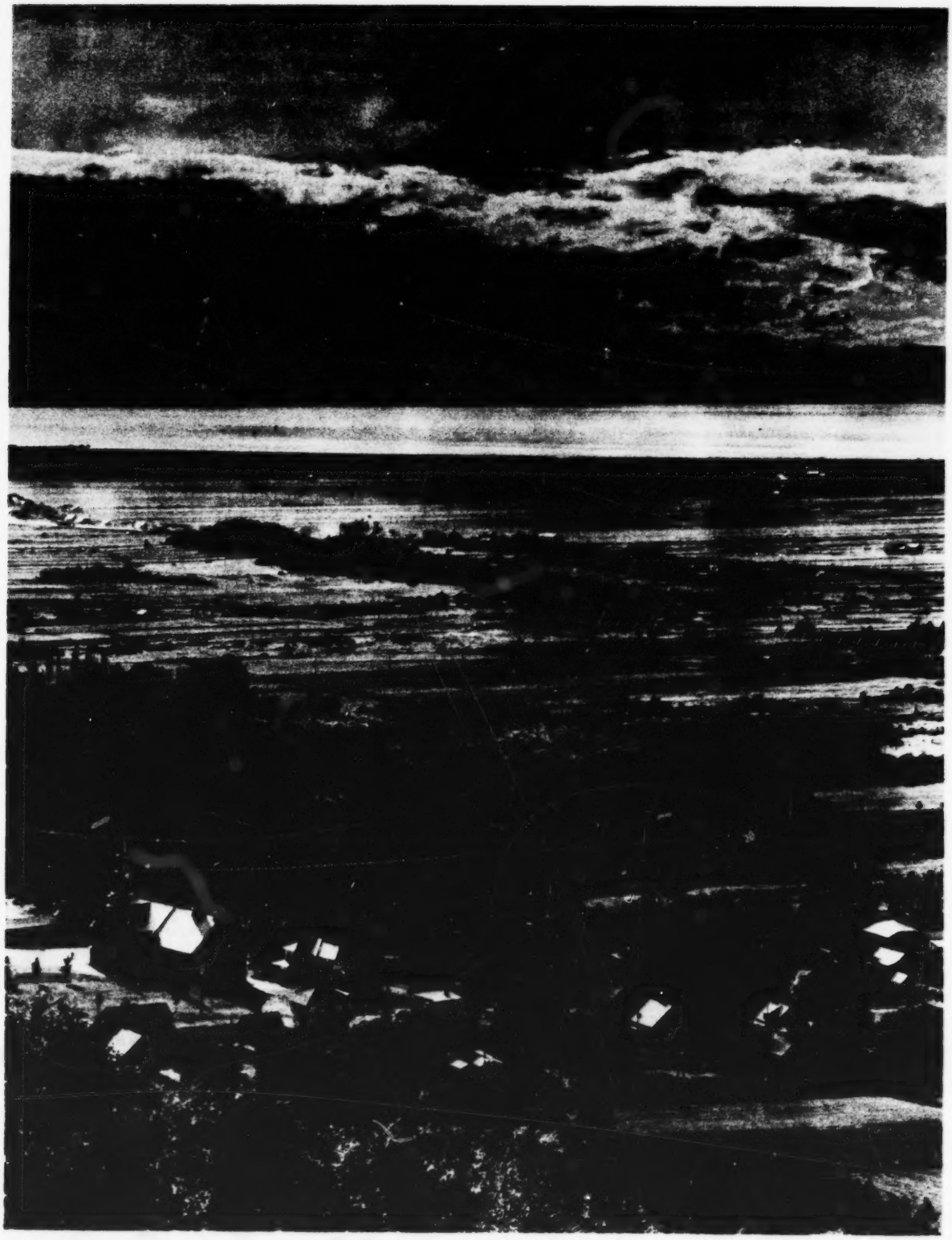


# 5. APPENDIX

## 5.1 CANADIAN AGRICULTURAL LAND RESOURCES AND LAND USE

### 5.1.1 Amount of Agricultural Land

Agricultural land resources can be defined as those soils and climates best suited to the commercial production of marketable foodstuffs. The amount and distribution of these lands in Canada are shown in Table 1, as taken from the Canada Land Inventory (Simpson-Lewis, et al. 1979).

These figures show that of Canada's total land mass of just over 922 million hectares:

i) Only 0.5 per cent (4.2 million ha) is in Capability Class 1, that is, soils with no physical limitations to production and capable of supporting the widest range of crops. Over half of this land is in southern Ontario.
ii) Only 5 per cent (45.9 million ha) of the land area is free of severe physical limitations (Capability Classes 1, 2 and 3) and capable of supporting field crops on a sustained basis. This area constitutes Canada's dependable land base for agriculture; 70 per cent is found in the Great Plains region (Alberta, Saskatchewan and Manitoba) and a further 27 per cent in Ontario and Quebec.
iii) Only 13 per cent (123.5 million ha) can support agriculture of any kind, including rough grazing (Capability Classes 1 through 6 inclusive).
iv) 86 per cent of Canada's land area is Capability Class 7 and has no capacity for modern mechanized agriculture (this includes such areas as parks, military reserves, and so forth which are not used for agriculture).

These data indicate agricultural land in Canada to be considerably less than expected.

One of the problems with CLI data is that they do not provide an adequate indication of the comparative agricultural value of Canada's land resources. This, however, can be approximated by integrating climate data with the CLI land base, through use of Williams' (1975) Agroclimatic Resource Index (ACRI). ACRI consists of the frost-free period divided by 60 with downward adjustments for significant moisture deficits and inadequate summer heat. The resultant ACRI values range from 3.00 in the Kent-Essex areas near Windsor to 1.00 in the northern agricultural frontier.

The value of ACRI depends on its success as a comparative index of crop productivity across Canada. This is shown in Table 2 using tame hay as the indicator crop (hay is the only crop grown in all regions in Canada). Using generalized, provincial ACRI values there is a close correlation between ACRI and yields in all provinces except British Columbia. In general areas with an ACRI value of 3.00 are two times as valuable from an agroclimatic standpoint as those with a value of 1.5, even though both may have been mapped as similar capability classes in the CLI.

TABLE 1. SOIL CAPABILITY FOR AGRICULTURE BY PROVINCE (ha X 1000)

| | Capability Class | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
| Newfoundland | 0 | 0 | 5.5 | 62.0 | 387.6 | 2 899.3 | 3 739.1 | 37 049.8 |
| P.E.I. | 0 | 261.3 | 141.5 | 49.8 | 76.0 | 0 | 27.7 | 565.7 |
| Nova Scotia | 0 | 166.3 | 982.5 | 424.3 | 82.2 | 14.3 | 3 510.7 | 5 384.3 |
| New Brunswick | 0 | 160.8 | 1 152.1 | 2 033.1 | 1 700.9 | 11.5 | 1 839.1 | 7 209.5 |
| Quebec | 19.5 | 909.7 | 1 281.0 | 2 585.3 | 1 659.4 | 10.7 | 20 765.3 | 135 683.0 |
| Ontario | 2 156.8 | 2 217.8 | 2 909.5 | 2 625.8 | 1 915.5 | 1 140.2 | 11 221.1 | 89 122.6 |
| Manitoba | 162.5 | 2 530.3 | 2 440.5 | 2 391.3 | 2 237.8 | 2 085.3 | 1 034.2 | 54 851.4 |
| Saskatchewan | 999.7 | 5 873.3 | 9 420.1 | 3 783.0 | 8 522.7 | 2 920.0 | 35.6 | 57 028.9 |
| Alberta | 786.6 | 3 839.0 | 6 110.0 | 9 285.2 | 11 101.0 | 3 934.1 | 4 191.6 | 64 441.2 |
| Brit. Columbia | 69.9 | 397.7 | 999.8 | 2 131.9 | 6 138.3 | 5 357.9 | 14 900.6 | 93 056.1 |
| Yukon and N.W.T. | | | | | | | | 377 836.7 |
| Canada | 4 195.0 | 16 356.0 | 25 442.4 | 25 371.5 | 33 821.5 | 18 363.4 | 61 265.0 | 922 130.0 |
| % within 80 km of major metropolitan areas | 56.8 | 28.6 | 19.8 | 11.9 | 7.3 | 8.1 | 12.5 | |

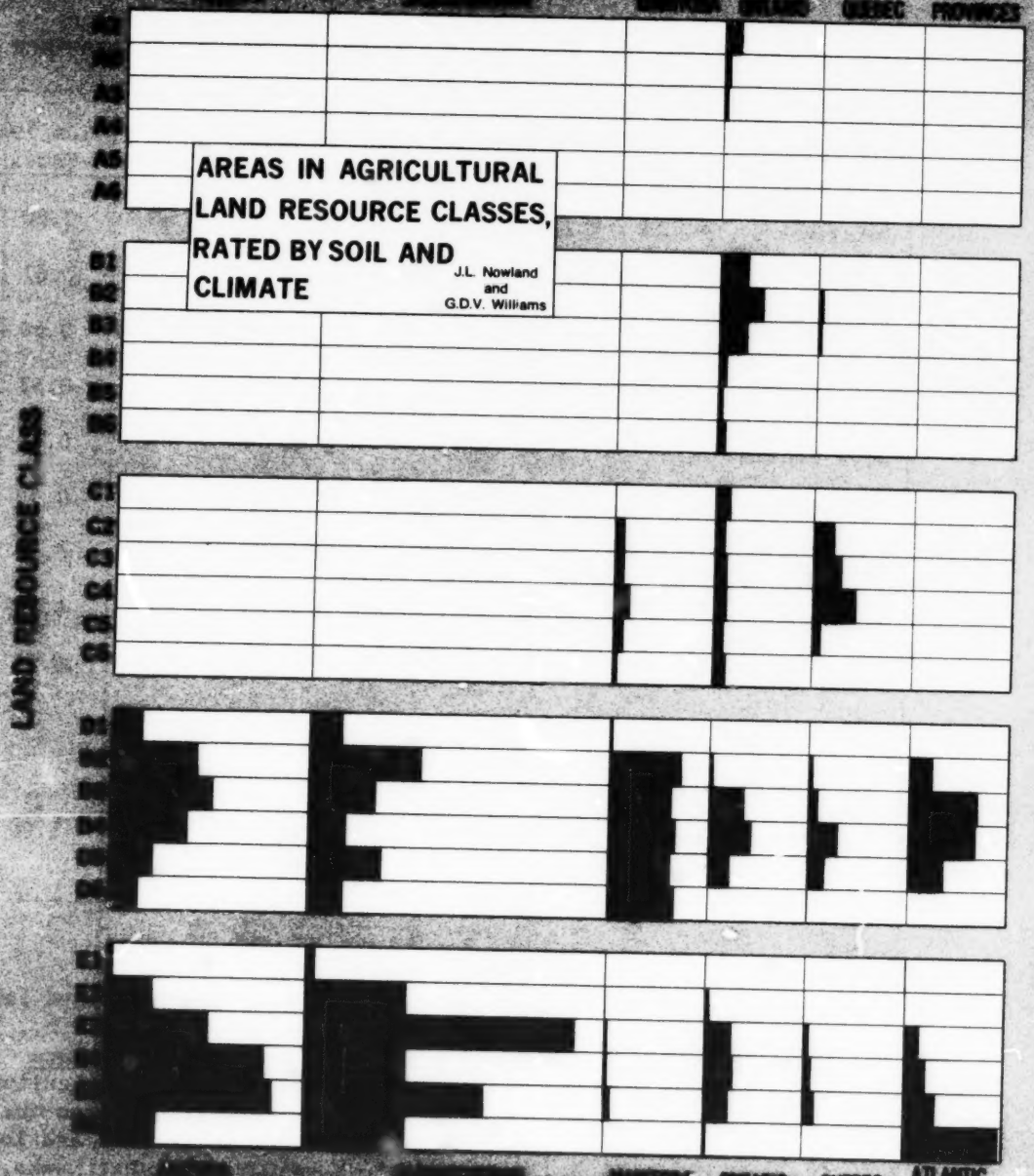
TABLE 2. AGROCLIMATIC RESOURCE INDEX AND HAY YIELDS BY PROVINCE

| Province | ACRI value | ACRI as ratio of Kent-Essex | Hay yields 1969-73 ratio of Kent-Essex yields |
|---|---|---|---|
| Ontario | 2.44 | 0.81 | 0.80 |
| Quebec | 2.00 | 0.67 | 0.61 |
| P.E.I. | 1.82 | 0.61 | 0.60 |
| Manitoba | 1.81 | 0.60 | 0.57 |
| Nova Scotia | 1.74 | 0.58 | 0.60 |
| New Brunswick | 1.70 | 0.57 | 0.59 |
| Alberta | 1.50 | 0.50 | 0.53 |
| Saskatchewan | 1.44 | 0.48 | 0.47 |
| Brit. Columbia | 1.35 | 0.45 | 0.83 |
| Newfoundland | 1.21 | 0.40 | |
| Yukon and N.W.T. | 1.00 | 0.33 | |
| Kent-Essex counties | 3.00 | 1.00 | 1.00 |

ACRI values and capability data have been combined into land resource classes as shown in Fig. 1. (Source: Nowland, J.L., 1977. "Canada's Land Resource", Land Evaluation and Systematic Data Collection, Workshop Proceedings, sponsored by Canada Agriculture, Research Branch, Ottawa, Ont. pp. 11-18.) This illustrates the very large predominance of agriculturally suitable soils that are located in inferior climatic areas, primarily in Alberta, Saskatchewan, Manitoba and the Atlantic region. The areas most highly favoured in relation to soils and climates amount to only 4.3 million ha (climates A and B and Capability Classes 1, 2 and 3), and these are exclusively in Ontario with minor areas in Quebec and British Columbia. In general, in Canada, a decrease in climatic quality results in decreased crop diversity potential and decreased yields.

# AREAS IN AGRICULTURAL LAND RESOURCE CLASSES, RATED BY SOIL AND CLIMATE

J.L. Nowland
and
G.D.V. Williams




The agroclimatic resource classes, with the corresponding ACRI values and typifying areas, are as follows:

A (ACRI ⩾3) Essex and Kent Counties, Ont.

B (ACRI 2.5 to 2.9) SW. Ont., areas near Lake Ontario and Georgian Bay. W. part of Montreal Plain.

C (ACRI 2.0 to 2.4) Lower Fraser Valley and Victoria area. Manitoba Plain N. of Winnipeg and Portage. Central Ont., Ottawa Valley. Manitoulin Is. Central St. Lawrence Lowlands of Que.

D (ACRI 1.5 to 1.9) S. interior valleys of B.C. and Vancouver Is. Parts of Upper Peace R. Valley, about half of the part of S. Alta. lying along and E. of an Edmonton-Calgary-Lethbridge line. Most of Sask. S. of Pr. Albert and E. of a North Battleford-Regina-Weyburn line. Most of Man. Plain and Interlake area. Thunder Bay, Algonquin Park and Clay Belt areas of Ont. Lac St. Jean and Riv. du Loup areas and area E. of Sherbrooke, Que. P.E.I., N.S. and S. part of N.B.

E (ACRI 1.0 to 1.4) N. interior valleys of B.C. Most of Peace and Athabasca River Valleys, parts of SE. Alta. Most of Sask. N. of Pr. Albert and Sask. W. of a North Battleford-Regina-Weyburn line. Riding and Duck Mts. in Man. Abitibi and Laurentides areas of Que. NW., NB. Most of Is. of Nfld.

The soil capability classes rate soils as follows:

1. No limitations for general field crops.
2. Moderate limitations that restrict range of crops or require moderate conservation practices.
3. Moderately severe limitations.
4. Severe limitations, suitable for only a few crops, or else the yield for a range of crops is low, or high risk of crop failure.
5. Perennial forage at best, but improvements feasible.
6. Perennial forage, improvements not feasible.

Data is not yet available for British Columbia; estimates for B.C. are 70,000 ha in Class 1, 398,000 ha in Class 2, 1 million ha in Class 3, 2.1 million ha in Class 4, 12 million ha in Class 5, 11 million ha in Class 6.

5.1.2 Current Agricultural Land Use Patterns

The 1976 census of Canada (Statistics Canada, 1977a) shows total farmland area as only 7.3 per cent of the land mass of the country (Table 3). Improved land occupies 4.7 per cent and cropland only 3.0 per cent. The three Great Plains provinces (Alberta, Saskatchewan and Manitoba) have 82 per cent of total improved land and 79 per cent of total cropland. Ontario and Quebec have 15 per cent of improved land and 18 per cent of cropland.

The above distribution is reversed when the value of agricultural sales are compared. Using 1971 data (agricultural sales data were not available in the 1976 census), Ontario and Quebec with only 16 per cent of improved farmland accounted for 46 per cent of agricultural sales. The Great Plains provinces with 81 per cent of improved farmland accounted for 45 per cent of sales.

These data illustrate the two basic agricultural land use systems currently being practiced in Canada. Western agriculture is characterized by cereal production, large land holdings, generally low productivity per unit area and extensive land management practises. On the other hand, eastern agriculture has smaller farms, a greater concentration of high value crops and more intensive land management. Average capital value per farm, however, is approximately equivalent for both systems (the national average capital value per farm in 1976 was $C 182,557 (Statistics Canada, 1978)).

Field crops grown in Canada and in each province in 1976 are listed in Table 4 (Statistics Canada, 1977b). These data illustrate the overwhelming dominance of cereals and hay in the Canadian agricultural economy. Cereals occupy approximately two thirds of total cropland and of this hard spring wheat makes up about 85 per cent. Tame hay for forage occupies approximately 20 per cent of cropland, with just under half of this area being in alfalfa.

The nature of Canadian soils and climates results in a regional distribution of agricultural production. Wheats, oil seeds, coarse grains, and fibre crops are grown primarily in Alberta, Saskatchewan and Manitoba (winter wheats are grown primarily in Alberta and Ontario because of particular climate requirements). Saskatchewan alone accounts for almost two thirds of all wheat grown in Canada, and over 50 per cent of oil seed production. Ontario and Quebec, because of warmer climates and a longer growing season account for 98 per cent of grain corn production and 91 per cent of corn fodder production.

Potatoes are grown primarily in the Atlantic provinces. They are also produced on sizeable areas in Ontario and Quebec but in cooler climates and slightly acidic soils. Tobacco is produced in Ontario, Quebec and Prince Edward Island, but in concentrated areas on sandy soils. Sugar beets for sugar are produced primarily in Alberta and Manitoba under irrigation.

Vegetables are produced in some quantities in all areas of Canada but the largest areas of production are in Ontario and Quebec. Availability to a large urban market as well as favourable soils and climates are necessary for vegetable

TABLE 3. CENSUS FARMS CLASSIFIED BY SIZE, AREA AND USE - 1976 (ha X 1000)

| | CANADA | NFLD. | PEI | N.S. | N.B. | QUE. | ONT. | MAN. | SASK. | ALTA. | B.C. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Total number of farms | 300 118 | 398 | 3054 | 3 441 | 3 244 | 43 097 | 76 983 | 29 963 | 69 578 | 57 310 | 13 033 |
| Total land area (ha) | 922 097.3 | 37 163.7 | 566.2 | 5 284.1 | 7 156.9 | 135 780.9 | 91 743.3 | 54 770.5 | 57 011.3 | 63 823.3 | 89 307.2 |
| Total area of farms (ha) | 67 168.2 | 29.4 | 278.0 | 400.2 | 402.3 | 3 654.1 | 5 966.8 | 7 610.0 | 26 432.6 | 20 040.0 | 2 351.8 |
| Improved land (ha) | 43 707.4 | 9.8 | 194.2 | 147.9 | 171.8 | 2 245.3 | 4 333.3 | 5 181.5 | 18 896.0 | 11 790.9 | 736.2 |
| Under crops (ha) | 28 041.8 | 3.5 | 151.8 | 100.1 | 126.5 | 1 737.8 | 3 414.8 | 3 829.5 | 10 589.3 | 7 614.1 | 473.8 |
| Improved pasture (ha) | 3 944.6 | 5.5 | 36.4 | 37.2 | 36.2 | 439.5 | 710.2 | 307.1 | 900.8 | 1 310.1 | 161.5 |
| Summerfallow (ha) | 10 873.4 | 0.1 | 2.2 | 2.6 | 1.6 | 18.2 | 69.3 | 925.7 | 7 176.5 | 2 610.7 | 66.3 |
| Other improved | 847.7 | 0.6 | 3.7 | 7.9 | 7.4 | 49.8 | 138.9 | 119.3 | 229.4 | 256.0 | 34.6 |
| Unimproved | 23 460.8 | 19.7 | 83.9 | 252.4 | 230.5 | 1 408.8 | 1 633.5 | 2 429.5 | 7 536.7 | 8 249.1 | 1 615.6 |
| Woodland | 3 982.5 | 6.8 | 68.5 | 206.2 | 190.3 | 1 021.5 | 761.0 | 362.9 | 407.1 | 683.1 | 275.2 |
| Other unimproved | 19 478.3 | 12.9 | 15.4 | 46.2 | 40.2 | 387.3 | 872.5 | 2 066.6 | 7 130.0 | 7 566.0 | 1 340.4 |

TABLE 6. CROPS ON CENSUS FARMS - 1976

| Crop | CANADA | NFLD. | PEI | NS | NB | QUE | ONT | MAN | SASK | ALTA | BC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Wheat total (ha) | 11 233 692 | 17 | 6 501 | 1 498 | 2 304 | 31 300 | 212 973 | 1 540 734 | 7 159 093 | 2 243 121 | 26 148 |
| 1. Winter Wheat | 338 515 | | 121 | 700 | 161 | 1 381 | 204 583 | 5 896 | 16 663 | 107 333 | 1 677 |
| 1. Durum Wheat | 1 402 340 | | 157 | 6 | 92 | 1 468 | 1 462 | 80 585 | 1 169 064 | 149 435 | 70 |
| 1. Other (wheat) spring sown | 9 482 837 | 17 | 6 223 | 792 | 2 051 | 28 451 | 6 928 | 1 454 253 | 5 973 365 | 1 986 353 | 24 401 |
| Oats-grain | 2 340 364 | 38 | 17 742 | 7 207 | 18 617 | 218 506 | 187 912 | 493 771 | 636 769 | 724 416 | 35 376 |
| Barley | 4 406 497 | 11 | 10 542 | 1 823 | 2 823 | 18 736 | 148 335 | 665 799 | 1 200 973 | 2 275 884 | 81 560 |
| Mixed grains | 637 399 | 24 | 32 850 | 2 290 | 2 591 | 43 087 | 329 095 | 69 681 | 47 531 | 108 138 | 2 108 |
| Rye total | 251 571 | | 378 | 481 | 31 | 4 919 | 22 893 | 37 447 | 109 677 | 73 032 | 2 711 |
| Rye fall | 230 625 | | 378 | 475 | 31 | 3 543 | 20 998 | 36 814 | 102 852 | 63 449 | 2 084 |
| Rye spring | 20 946 | | | 6 | 1 | 1 375 | 1 895 | 634 | 6 825 | 9 583 | 627 |
| Buckwheat | 27 640 | | 79 | 74 | 737 | 4 259 | 4 285 | 17 663 | 190 | 304 | 48 |
| 4. Field peas (dry) | 27 262 | 5 | 399 | 12 | 212 | 762 | 1 130 | 15 288 | 6 137 | 3 027 | 289 |
| 2. Field beans (dry) | 77 146 | | 235 | 98 | 168 | 955 | 69 108 | 2 974 | 407 | 3 168 | 32 |
| Grain corn | 708 187 | | 262 | 1 163 | 108 | 62 229 | 635 459 | 6 701 | 497 | 1 126 | 640 |
| Tame hay total | 5 539 820 | 2 239 | 51 412 | 62 330 | 64 073 | 1 033 967 | 1 095 572 | 566 535 | 871 454 | 1 540 717 | 251 235 |
| Alfalfa | 2 614 082 | 144 | 6 783 | 4 706 | 5 330 | 149 203 | 567 448 | 389 842 | 586 931 | 801 243 | 102 441 |
| Other tame hay | 2 925 738 | 2 095 | 44 628 | 57 624 | 58 743 | 884 764 | 528 124 | 176 693 | 284 523 | 739 474 | 148 794 |
| Oats-fodder | 489 772 | 123 | 804 | 2 338 | 3 066 | 89 358 | 22 878 | 20 528 | 128 038 | 201 827 | 20 712 |
| 2. Corn-silage/fodder | 496 015 | 6 | 4 640 | 5 025 | 2 427 | 102 751 | 347 430 | 13 189 | 1 723 | 10 568 | 8 256 |
| Other fodder crops | 152 347 | 87 | 609 | 1 146 | 1 495 | 43 910 | 17 594 | 9 847 | 21 533 | 51 785 | 4 340 |
| Flaxseed | 329 596 | | | | | 410 | 4 887 | 211 517 | 82 924 | 29 656 | 203 |
| 3. Soybeans | 151 981 | | | 17 | 4 | 237 | 151 100 | 309 | 183 | 127 | 4 |
| Sunflowers | 24 399 | | 4 | | 1 | 104 | 349 | 20 176 | 2 324 | 1 439 | 1 |
| Rapeseed | 696 243 | | | 1 | | 171 | 266 | 93 440 | 291 629 | 299 397 | 11 317 |
| Mustard seed | 36 097 | | 4 | 1 | | 110 | 576 | 7 433 | 19 183 | 8 789 | 1 |
| 5. Potatoes | 105 919 | 399 | 20 818 | 1 459 | 22 308 | 17 011 | 18 303 | 13 973 | 782 | 6 536 | 4 311 |
| Tobacco | 39 744 | | 1 399 | 221 | 130 | 3 825 | 34 161 | | | | |
| Sugarbeets or sugar | 33 846 | | 201 | | 233 | 3 118 | 2 | 13 329 | | 16 949 | 15 |
| Other field crops | 47 523 | 16 | 230 | 239 | 316 | 8 434 | 14 317 | 6 550 | 7 483 | 8 363 | 1 575 |
| Vegetables | 113 205 | 519 | 2 321 | 2 940 | 2 816 | 33 291 | 57 198 | 2 067 | 472 | 4 287 | 7 289 |
| Tree fruits | 49 583 | 1 | 36 | 4 655 | 821 | 10 441 | 22 249 | 153 | 81 | 371 | 10 774 |
| Small fruits | 24 388 | 22 | 347 | 4 969 | 1 219 | 2 390 | 11 465 | 124 | 21 | 99 | 3 731 |
| Nursery products | 8 801 | 8 | 13 | 55 | 25 | 1 307 | 5 019 | 253 | 177 | 983 | 962 |

production. Fruits are concentrated in the Annapolis Valley of Nova Scotia, Niagara area of Ontario, and the Okanagan Valley of British Columbia, with lesser amounts in Quebec. Niagara alone accounts for 81 per cent of Canada's grape growing area, 59 per cent of the peach area, 55 per cent of the sour cherry area and more than 33 per cent of the pear, plum and sweet cherry areas.

Crops related to livestock production particularily tame hay, corn, mixed grains and feed grains such as oats and barley, are produced in all areas of Canada. Cattle are common on up to about 70 per cent of Canadian farms but the highest concentrations are in Alberta and Ontario. Beef operations are found in all regions of the country. Dairies predominate around large urban centres, mostly in Ontario and Quebec.

### 5.1.3 Changing Characteristics of Canadian Farms

Canadian agriculture has changed considerably since original colonization, but the biggest changes have occurred in the last three decades. The changes have been reactive to a series of internal and external forces, including fluctuating prices at the farm gate, escalating operating costs, variable but low farm incomes, uncertain national and international markets, increasing mechanization and technological innovation, regional disparities but commodity surpluses, transportation and marketing problems, urban encroachment and fragmentation, and many other factors. The exact nature of the changes are difficult to describe but certain trends are clear.

#### i. Farm size

Total land area of the average farm has increased from 80 to 224 ha in the last 50 years (the average size of a western grain farm is 328 ha compared to 95 ha in an eastern farm). These changes have been accompanied with major shifts towards mechanization, greatly increased reliance on fossil fuels for energy, greater fertilizer, herbicide and fungicide usage, increased unit area productivity, small farm consolidation, greatly increased land prices and a growing tendency towards mixed (part owned, part rented) tenure.

#### ii. Farm population

Canadian farm population declined 68 per cent between 1931 and 1976, but the rate of decline was most dramatic (29 per cent) between 1971 and 1976. In 1976 rural farm population was only four per cent of Canada's total population, and 18 per cent of the rural population. This outward migration, the result primarily of low and uncertain farm income, has created a serious shortage of skilled farm labour.

iii. Age of farmers

In 1976, 31 per cent of farm operators were over 54 years of age, 10 per cent were 65 or older and 19 per cent were under 34 years of age. The reduction of farm population coincident with the increased retirement of older farmers provided opportunities for farm consolidation and enlargement, but this requires considerable capital outlay. Land prices are high (about $C 600 per ha for wheatland and $C 3,500 per ha for cornland), as is the cost of borrowing. Government subsidized credit schemes have had to be introduced. Although the family farm has remained the dominant form of agricultural enterprise, mixed tenure and partnership arrangements have become more common.

iv. Total capital value

Total capital value includes investment in land and buildings, machinery and equipment, and livestock and poultry. In 1976 the total capital value of Canadian farms was $C 54.8 billion, with an average value per farm of $C 182,557 (the average capital value per farm ranged from $C 91,148 in Quebec to $C 237,353 in Alberta). Between 1951 and 1976 the capital value of land and buildings has risen from 58.4 to 75.8 per cent of total capital value, whereas machinery and equipment has dropped from 20.4 to 16.1 per cent, and livestock and poultry has dropped from 21.2 to 8.1 per cent. The fact that almost three quarters of total capital value is accounted for by land and buildings reflects the escalating price of land, the intense competition for agricultural land from other nonagricultural uses, and the premium farmers are prepared to pay for quality agricultural land.

v. Unit area productivity

National average spring wheat yields for the period 1965-75 were 1.6 tonnes per hectare. Corresponding yields for barley, soybean and grain corn were 2.1, 2.0 and 5.0 tonnes per hectare (Statistics Canada, 1978). Canadian trend yields for spring wheat have averaged between 1.6 and 2.0 per cent per year for the period of 1958-76. National corn yields increased about 3.5 per cent per year between 1951-66, but only at about 0.6 per cent per year thereafter. National barley yields remained relatively stable up to 1961, but increased at the rate of about 5.4 per cent per year up to 1971. Between 1971-76 barley yields have increased at the rate of only 0.5 per cent per year. Estimates cannot be provided for soybean because of insufficient data.

The declining yield increases are difficult to interpret, but they are in keeping with observations from western Europe and the United States. They may be due to decreased fertilizer inputs due to increased energy costs, bringing poorer quality land into production because of expanded markets, a general deterioration of climate, or some other factors. Whatever the reasons, it is well known that productivity increases in the future will be much harder to obtain than were those of the past.

### 5.1.4 Changing Agricultural Land Use Patterns

Some recent changes in agricultural land use patterns in Canada are summarized in Tables 5 and 6 (Simpson-Lewis, et al. 1979).

Table 5 reports the net change in total farmland by province and by Agroclimatic Resource Index (ACRI). It shows a decrease in total farmland in the warmest areas of Canada and an increase in the coldest regions. Collectively farmland has been reduced in Ontario, Quebec and the Atlantic provinces, whereas it has increased in the Great Plains and in British Columbia. The national balance shows a net decrease of approximately 1.2 million hectares between 1961 and 1971, primarily from the most climatically favoured areas.

Table 6 illustrates changes in total and improved farmland between 1956 and 1976 and compares this to the ACRI index. It shows that even though total farmland increased between 1956 and 1966, the net change relative to ACRI was negative, and that this was accentuated even further between 1966 and 1976. For improved farmland the net change remained positive between 1956 and 1966 but reversed to negative between 1966 and 1976 even though total improved farmland increased. The biologic production potential of the 1.6 million ha gained in the western provinces could not offset the effect of the 1.2 million ha lost primarily in Ontario and Quebec.

The changing agricultural land use patterns are the result of complex interactions between a wide variety of physical, economic and social factors. Land marginal for agriculture has been abandoned, prime farmland has been subdivided and fragmented by urban, transportation, estate development and recreation activities, there has been a gradual change towards more variable weather conditions, and there has been a deterioration of soil quality due to improper management and inadequate rotations. Concurrently, widely fluctuating prices at the farm gate, uncertain and fluctuating markets, rapidly escalating production and interest costs, and changing demographic patterns have acted to create large structural changes within the agricultural sector. Indications are that agricultural adjustment will continue at least over the next few decades.

### 5.1.5 Implications of Current Land Use Trends

Canadian agriculture has experienced a considerable rate of change over the last few decades. Some of the most pertinent implications of this from the perspective of land resources are summarized below.

1. The idea of a vast cropland reserve in Canada may be more of a myth that a reality. Indications are that the majority of Class 1, 2 and 3 land is presently in production (44.2 million ha of improved farmland in 1976 compared with 45.9 million ha of Capability Class 1, 2 and 3 soils). Class 4 lands which constitute the majority of the remaining reserve, can be used for only a narrow range of crops and are best suited for forage based livestock operations (they are used for tobacco in climatically suited areas). Experience has shown the high risk involved in farming Class 4 soils.

TABLE 5. NET CHANGE IN TOTAL FARMLAND BY PROVINCE AND AGROCLIMATIC RESOURCE INDEX, 1961 to 1971

| ACRI Value | Net change in Farmland (ha X 1000) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Atlantic Provinces | Quebec | Ontario | Manitoba | Saskatchewan | Alberta | British Columbia | ACRI Total |
| >2.9 | 0 | 0 | -10 | 0 | 0 | 0 | 0 | -10 |
| 2.5-2.9 | 0 | -34 | -254 | 0 | 0 | 0 | 0 | -288 |
| 2.0-2.4 | 0 | -710 | -607 | +136 | 0 | 0 | -49 | -1 230 |
| 1.5-1.9 | -788 | -551 | -187 | +203 | +194 | +57 | -137 | -1 209 |
| 1.0-1.4 | +3 | -71 | 0 | 0 | +66 | +865 | +720 | +1 583 |
| Total | -785 | -1 366 | -1 058 | +339 | +260 | +922 | +534 | -1 155 |

TABLE 6. NET CHANGE IN AGRICULTURAL LAND USE IN CANADA (ha X 1000), 1956 to 1976

| 1956 | 1966 | 1976 | 1956 to 1966 change | 1956 to 1966 ACRH* change | 1966 to 1976 change | 1966 to 1976 ACRH change |
|---|---|---|---|---|---|---|
| | | | Total Farmland | | | |
| 70 386.9 | 70 468.2 | 68 429.4 | +81.4 | -1 435.4 | -2 038.9 | -4 756.1 |
| | | | Improved Farmland | | | |
| 40 602.0 | 43 770.1 | 44 229.2 | +3 168.0 | +4 261.8 | +458.1 | -38.0 |

* Agroclimatic Resource Hectare - the product of the ACRI value and the hectares of farmland.

ii. There has been a shift in the land base for agriculture from central Canada to the west. This has resulted in a net decrease in national production potential as cooler and drier areas are substituted for lands in Ontario and Quebec.

iii. There has been a gradual shift towards more intensive land use as the cropland area has contracted. This can lead to deterioration of soil and environmental quality if proper management practises are not instituted.

iv. Cheap energy and the substitution of capital for labour have been some of the major contributors to increasing average farm size and ever larger farm machinery. By and large this has resulted in increased economic efficiency, but it has also promoted erosion, organic matter loss and general soil quality depletion.

v. Land and buildings currently constitute 75 per cent of total capital value at the farm level. This reflects the premium that farmers are prepared to pay for quality agricultural land, but in an indirect manner it indicates the extent of non-agricultural competition for this same land resource.

vi. Areas with unique combinations of soils and climate, making them ideally suited for the production of special crops are under intense competitive pressure from urbanization and transportation. Only British Columbia, Quebec and Newfoundland have enacted legislation to protect agricultural land.

vii. The continual reduction of the agricultural land base is eroding Canada's position in agricultural trade. In 1977 Canada's agricultural trade balance on commodities produced commercially in Canada was just over $2.0 billion. However, when cereal grains are excluded the balance is reduced to minus $96 million. In fact a negative trade balance has existed in Canada since 1974 when grains are excluded.

## 5.2 REFERENCES

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